Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Papers on Plant Genetics

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School of Agriculture

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The Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

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Papers on Plant Genetics
Vol. I, No. 2.

Part I. British Empire.

GENETICS (575)

101. **Weiss, F. E.** **575.257**
The problem of graft hybrids and chimaeras.
Biol. Rev. Cambridge Philos. Soc., 1930, **5**, pp. 231–71.
A discussion of a large number of authors' results in connection with graft hybrids and the possibility of their being explained as periclinal chimaeras. Although no actual case of the fusion of vegetative cells has been observed in the higher plants yet, the author does not deny its possibility.
The author also calls attention to the economic possibilities of certain periclinal chimaeras in the prevention of insect and fungus attacks.

102. **Waterhouse, W. L.** **633.1–2.452:576.16**
Australian rust studies II. Biometrical studies of the morphology of spore forms.
Proc. Linn. Soc., N.S.W., 1930, **55**, pp. 159–78.
Spore measurements were made on a number of naturally occurring and one "hybrid" rust forms. Differences in size were quite marked and in general corresponded with physiologic differences, groups of forms which were related physiologically being similar in size. There were exceptions, however, to this rule.

103. **Calder, J. W.** **633.11:575.116.1:581.466**
Carpellody in the wheat flower and its inheritance.
Trans. & Proc. N.Z. Inst., 1930, **61**, pp. 391–401.
An abnormality of the flower was noticed in a wheat plant in 1924. The glumes remained expanded for 7 to 10 days. The stamens were transformed into carpelloid structures not resembling anthers, or into structures intermediate between the two, or bore only a few stigmatic hairs at the apex. In some florets all three anthers were affected, in others only one or two. The greatest abnormality usually occurred in the lowest floret of the spikelet; thus these lower florets produced less grain than the upper ones. No grain ever set in abnormal carpels. Ergot, a rare disease in New Zealand, was largely present in the abnormal florets.
Anatomical investigation shewed that all the normal tissues associated with the carpel were present with the exception of the embryo sac.
One plant first occurred among 25 F_1 plants of a cross—39 grains were obtained from it, of which five produced abnormal plants. These were self-pollinated and all the offspring were abnormal.
In crosses with normal plants the character behaved as a recessive. No segregation occurred in F_2, indicating that it is not due to a single gene. It appears to be linked with certain morphological characters.

104. **Harrington, J. B.** **633.11 Marquis:575.22**
The source and nature of variability in a strain of Marquis wheat.
Sci. Agric., 1930, **11**, pp. 44–55.
Plants from a strain of Marquis wheat could be divided into three types:—*C* typical Marquis, *B* with many characters markedly different from Marquis, and *A* forms, intermediate between *C* and *B*. A study of type *A* shewed that natural crossing between *C* and *B* was mostly responsible for type *A*. The effects of environment were not sufficient to mask inherited differences. Shape of beak and glume shape were found to be the most reliable differentiating characters.

105. **Melburn, M. C.** **633.11:576.354.46:575.127**
Heterotypic prophases in the absence of chromosome pairing.
Can. J. Res., 1929, **1**, pp. 512–27.
The meiotic prophases of a wheat-rye hybrid were studied and compared with the rye parent. The pre-synezetic stages were alike in almost all points, the spireme filaments which emerge were double in both cases, although in the hybrid no mating of the chromosomes takes place.
The first differences were observed when the hybrid entered the second contraction phase early, without mating. The evidence suggests that the spireme is composed of univalent chromosomes "in tandem" and that mating begins in the post-synezetic period. This affords ample opportunity for crossing-over.

ECONOMIC PLANTS (633)

106. **633.11–2.112–1.521.6:575**
Wheat breeding activities.
J. Dept. Agric. Vict., 1930, **28**, pp. 541–44.
The State Research Farm has bred a number of prolific drought-resisting wheats which are rapidly displacing older varieties. A brief description and the yields of the more successful of these is given. Varieties resistant to flag smut are also being developed.

107. **Newton, M., Johnson, T., and Brown, A. M.**
633.11–2.452:576.16:575.11.061.6
A study of the inheritance of spore colour and pathogenicity in crosses between physiologic forms of *Puccinia graminis tritici*.
Sci. Agric., 1930, **10**, pp. 775–98.
Crosses were made between form 9*a* (orange) and form 36 (greyish-brown) in a manner similar to that described in a previous paper. The former is homozygous, the latter heterozygous for pathogenicity; both are homozygous for colour. The colour of the urediniospores of the first generation hybrids was generally normal red. Certain exceptions were explained as a result of mixing of cultures, others to mutation. All belonged to form 17 or 17*a*; when form 36 acted as the maternal pustule to which pycniospores of the other form were transferred, form 17, which resembled form 36 in reaction, was produced. When form 9*a* acted as the maternal pustule, form 17*a*, resembling 9*a*, resulted. These results are attributed to cytoplasmic inheritance. Forms 17 and 17*a* differ only in their reaction on Marquis and Kota.
Form 9 (red) and 15 (red) were crossed similarly, resulting in form 9 in both cases.
Form 9*a* (orange) x 52 (greyish-brown) gave red urediniospores, with two exceptions, supposedly due to mutations. Forms 9 and 9*a* were the only ones produced, their occurrence being governed by the same phenomenon of cytoplasmic inheritance.
In the cross 14 (red) x 36 (greyish-brown) all resulting urediniospores were red. In this case the parent forms differed widely in pathogenicity and four distinct forms emerged; cytoplasmic inheritance was again evident.
Second generation hybrids were obtained from the first two crosses by selfing the first generation hybrids on the barberry. A normal coloured culture of form 17*a* resulting from the first cross of 36 x 9*a* was selfed in this way. The second generation hybrids resulting were of four different colours: red, orange, greyish-brown and white. The proportion of white agreed rather closely with the assumption of two independently inherited colour factors.
Seven different physiologic forms were recovered, and four of these shewed the two types previously described as the result of cytoplasmic inheritance, though had this been the case, only one type would have appeared. The difference between these two types seem in some way to be associated with the colour, since for instance the 17*a* type occurred more frequently in the orange and the 17 type more in the red. Nevertheless it is shewn that the colour is not inherited through the cytoplasm.
Pathogenicity is not in general linked with spore colour.
The distribution of forms may be said to conform with a three-factor type of inheritance. The parental form 9 did not appear among the progeny.

In the second generation hybrids from the second cross 9 (red) x 15 (red), the aecia were of two colour types, normal orange and white. The urediniospores from the whitish aecia were abnormal (greyish-brown) in colour. It is assumed that the parental form 15 was heterozygous for colour. In addition to the two parental forms, forms 85 and 57 were produced. The latter shews evidence of transgressive segregation, being more virulent than either parent. Form 85 preponderated largely in the greyish-brown cultures, shewing an association between pathogenicity and spore colour. Apart from this the proportions perhaps indicate a bi-factorial inheritance.

108. **Newton, M., Johnson, T., and Brown, A. M.**
633.11–2.452:576.16:575.114

A preliminary study on the hybridization of physiologic forms of *Puccinia graminis tritici*.

Sci. Agric., 1930, **10**, pp. 721–31.

A method is described whereby selfings and crossings of rust forms can be obtained by pycnial intermixtures on the barberry.

Of eight physiologic forms, all but one shewed segregation on selfing, the number of forms derived from one selfed form varying thus from one to eighteen. Of the total forms so derived, twelve were new forms, eighteen were old, recognised forms.

The results of a number of hybridizations are recorded. Number 15 x 9 (the sole homozygous form) gave number 9 only ; number 49 x 17 gave form 30 only, but a further cross of these two, 17 x 49, gave in some cases form 30, in another case a new form, 93, and another cross still furnished form 52, and another new form 87.

A culture arising from the mixing of eight different forms gave seventeen forms, of which seven were new ; each individual cup contained only one form.

109. **Stakman, E. C., Levine, M. N., and Cotter, R. U.**
633.11–2.452:576.16:575.114

Origin of physiologic forms of *Puccinia graminis* through hybridization and mutation.

Sci. Agric., 1930, **10**, pp. 707–20.

After a discussion of the references to hybridization and mutation of rust forms in the literature, experiments are described in which pycnia were transferred from *Puccinia graminis agrostidis* to *Puccinia graminis tritici*, form 36.

Aecia were formed in every case, although the reciprocal cross was unsuccessful. From the cross, 12 distinct forms were isolated, some of which were previously unknown ; eight distinct forms issued from a single aecial cup, several of them new to North America. The forms derived are described ; some of them were more virulent than the original form of *tritici*, and one more virulent than any previously known form ; the uredinia were of three different colours.

Further crosses of *P.g. secali*, form 11 x *triciti*, form 36, are described, in which forms different from the parental ones were obtained, the derived forms differing in virulence from the parental forms, two being completely new forms.

The origin of an unknown form, which proved to be constant, in a culture of form 1, hitherto constant over a period of 13 years, is described. This mutant form is less virulent than the original, but other mutants from the same original form are described which are considerably more virulent.

110. **Goulden, C. H., Newton, M., and Brown, A. M.**
633.11–2.452–1.521.6:575

The reaction of wheat varieties at two stages of maturity to sixteen physiologic forms of *Puccinia graminis tritici*.

Sci. Agric., 1930, **11**, pp. 9–25.

Fourteen varieties were tested, including susceptible vulgare types, resistant vulgare types and resistant emmer types. The seedling reaction of the varieties was known and compared with the mature plant reaction as determined in this investigation.

Some varieties shewed a very close agreement between the seedling reaction and mature plant reaction ; other varieties shewed no agreement, being much more resistant in the mature plant

than in the seedling stage. Thus Acme and others were resistant to all forms in the mature stage, but quite susceptible in the seedling stage.
The reaction of the intermediate varieties is also described. The varieties shewing mature plant resistance have invariably a small number of pustules, although the pustules themselves may be quite large ; *i.e.* the fungus apparently has difficulty in penetrating the host.
All the varieties shewed in the mature stage a tendency to be more resistant in certain regions than in others. This is styled " regional resistance." The young tissues above the nodes and in the neck are more heavily infected.
It is pointed out that the mature plant type of resistance corresponds to the so-called functional resistance based on stomatal behaviour ; from the breeding point of view this type of resistance is very important as it is inherited on simple Mendelian lines.
A number of complications indicate that other effects are also operative.

111. **Jones, E. T.** **633.13:575.242**
Morphological and genetical studies of fatuoid and other aberrant grain-types in Avena.
J. Genet., 1930, **23**, pp. 1–68.

Fatuoids were observed :—
(*a*) In the following established varieties of oats : Orion, Ceirch-du-bach, Royne, Cornellian and Record, all *A. sativa*, Fulghum, *A. sterilis culta*, Golden Giant, *A. sativa orientalis*, and *A. nuda*.
(*b*) Among the progeny of artificial crosses : President (*A. sativa*) x Pioneer (*A. sativa orientalis*) ; Victory (*A. sativa*) x Red Algerian (*A. sterilis culta*), and Red Algerian x Scotch Potato (*A. sativa*).
(*c*) A sub-fatuoid type from the cross Red Algerian x Golden Rain.
(*d*) Strongly awned mutants resembling fatuoids but without the typical grain base.

The fatuoids were backcrossed with the normal varieties and the results are described.
A fatuoid from Golden Rain showed an association between low spikelet number and the fatuoid characters. Factors for grain colour and for length of pubescence were found to be inherited independently. The possibility of the origin of fatuoids by natural crossing is held to be untenable. The theories of Nilsson-Ehle and Huskins are discussed and a modified form of that of Huskins is suggested to account for the facts presented in this paper.

112. **Cunliffe, N.** **633.13–2.7–1.521.6**
Studies on *Oscinella frit. Linn.* Comparative records of oat grain infestation in Sweden during the year 1927, together with a note on sterility or " blindness " of grain.
Ann. Appl. Biol., 1930, **17**, pp. 549–53.

All but one of the very early shooting varieties escaped serious infection. Of the late varieties some were less infected than others and are probably resistant. Blindness was not correlated with frit fly infection, it must therefore be due to other causes. Degree of sterility apparently is a varietal character.

113. **Darragh, W. H.** **633.15:575(94.4)**
Maize improvement by breeding and selection.
Agric. Gaz. N.S.W., 1930, **41**, pp. 677–83.

Improvement is still being effected by ear-to-row selection. Over a period of seven years the average increase in yield was 4·1 bushels per acre. A certain number of selfed lines have been established ; crossing these by artificial pollination and close pollination of sister plants is being tried in the hope that these methods may ultimately benefit the farmer.

114. **Sethi, R. L., and Saxena, B. P.** **633.18(54)**
Classification and study of characters of the cultivated rices in the United Provinces.
Mem. Dept. Agric. Ind. Bot., 1930, **18**, pp. 149–209.

A classification of a large number of local varieties on various vegetative and reproductive characters, given in tabular form, preceded by a discussion of the characters used.

115. **Bhalerao, S. G.** **633.18:581.148.3:575**
The grain-shedding character in rice plants and its importance.
Imp. Inst. Agric. Res., Pusa, Bull., **205**, 1930.
Wild rices are shewn to be more prone to cross-fertilization than cultivated types. They thus tend to cross with the cultivated rice and introduce their undesirable characters of which one of the worst is the tendency to shed the grains.
The progenies of a large number of plants of cultivated rice in which this character had appeared were examined ; it was shewn that the shedding type was dominant to non-shedding, although a non-shedding parent frequently gave both shedding and non-shedding offspring.
In 1925, shedding plants in 12 cases gave only shedding offspring, in 17 cases both shedding and non-shedding. Non-shedding plants in 14 cases gave non-shedding offspring only, in 13 cases moderately shedding offspring, and in eight cases both shedding and non-shedding. The author concludes that more than one factor pair is involved. This makes it particularly difficult to remove the character once it is introduced, since it may be transmitted by individuals which do not shew it.
The results point to a complete lack of association in inheritance between shedding and any of the other characters studied ; nevertheless, since such characters as black, brown or flecked glumes come from the wild types, they tend to be associated with shedding in any particular plant.

116. **Weiss, F. E.** **633.51:575.255**
Grafting and graft-hybrids in connection with cotton plants.
Emp. Cott. Grow. Corp., Conf. Cott. Grow. Problems, Rep. & Summary of Proc., August, 1930, pp. 158–61.
It is suggested that staple length might be combined with other desirable features if periclinal chimaeras could be created.

117. **Roberts, W.** **633.51–2.2–1.521.6(54)**
" Crop failures " and mixing of Punjab American.
Emp. Cott. Grow. Rev., 1930, **7**, pp. 275–78.
Some of the new selections in the Punjab do not suffer from the " crop failures," apparently as a result of immunity to " White Fly."

118. **Khan, A. R.** **633.524.35**
A new type of roselle hemp.
Agric. J. Ind., 1930, **25**, pp. 210–12.
A new variety of *Hibiscus sabdariffa* with long stem, little branched, and good quality fibre. In addition to this, it is immune to " wilt."

119. **Barnes, H. F.** **633.584.3–2.2–1.521.6**
On the resistance of basket willows to button gall formation.
Ann. Appl. Biol., 1930, **17**, pp. 638–40.
Tests were made of certain varieties under conditions of artificial infestation with *Rhabdophaga heterobia*. One variety proved to be immune.

120. **Venkataraman, T. S.** **633.61:575**
Sugar cane breeding—its chief characteristics.
Madras Agric. J., 1930, **18**, pp. 417–21.
A discussion of variation in seedling canes, of hybridization technique and species crosses, followed by an account of an intergeneric hybrid with *Andropogon Sorghum*. This hybrid matured in a period as short as five months, at which time its sugar content was almost as high as that of the standard canes. The production of such a cane promised to bring about a great extension of sugar cane cultivation.

121. **633.61:575(94.3)**

Queensland seedling canes.
Aust. Sug. J., 1930, **21**, p. 676.

A number of seedling canes are described and their yields and production of sugar compared with Badila. One gave very high yields, although the sugar content was a trifle low. Large numbers of crossings have been made but only recently has *S. spontaneum* been used.

122. **C. A. B.** **633.61:575(96.9)**

Cane breeding work in Hawaii.
Int. Sug. J., 1930, **32**, pp. 453–5.

It is hoped to produce valuable canes by interspecific crossing. The crossing technique is described. Certain X-ray treatments were performed on the germinating seeds. The procedure of selection is described and descriptions given of the most promising seedlings raised.

123. **C. A. B.** **633.61:576.3**

Cytology and its use in the classification of canes.
Int. Sug. J., 1930, **32**, pp. 450–3.

A general account, giving some of the chief points in Bremer's lecture to the International Society of Sugar Cane Technologists in Java, 1929, and which has been printed in the Proceedings.

124. **McIntosh, A. E. S.** **633.61:581.162.3**

Pollen shedding in Barbados sugar cane variety.
Trop. Agriculture, 1930, **7**, pp. 296–99.

The extent and time of arrowing and pollen shedding and the female fertility must be studied for each variety used in breeding. A full study is presented of the pollen shedding under Barbados conditions of a number of the Barbados canes. Arrows were held over a smeared plate divided into squares and gently tapped at periods of half an hour and the amounts shewn on a graph. Pollen was shed only between 2 a.m. and 10 a.m., and the vast majority shedding between 6 a.m. and 8.30 a.m.

Varieties differed notably in the time of attaining the maximum, in the duration of the period of maximum shedding and in the amount of pollen shed. The shedding appears to be largely influenced by evaporation.

125. **633.61:633.174:575.127**
633.51:575"793"

Association of economic biologists.
Madras Agric. J., 1930, **18**, pp. 533–37.

A report of a paper read to the Association of Economic Biologists by T. S. Venkatraman, previously reviewed. A prolonged discussion is also reported, in which further information on the sugar cane x sorghum hybrid was forthcoming, and the possible importance of the cross further emphasized.

A paper by V. Ramanathan is also reported in which it is shewn that the position of the first fruiting node in cotton, and with it therefore the earliness, is governed by multiple genetic factors.

126. **Majumdar, V. M.** **633.71:575**

Studies in Gujarat Tobaccos and their improvement, Part I.
Mem. Dept., Agric. Ind. Bot., 1930, **18**, pp. 89–125.

Includes a description of the varieties of tobacco cultivated in Gujarat with methods of cultivation and climate. The following characters were studied over a three-year period in eight strains of tobacco and though subject to marked fluctuation in some cases, their hereditary nature is shown.

(1) Length and greatest breadth of leaves and the leaf-ratio in plants grown for seed.
(2) Length and greatest breadth of leaves and the leaf-ratio in plants grown for leaf.
(3) The number of leaves per plant.

(4) The number of veins in a leaf.
(5) The thickness of the leaf.
(6) The height of the plant.
(7) The number and size of suckers and their time of appearance.
(8) The period required for flowering.
(9) The character of the inflorescence.

The ideal type of tobacco plant for N. Gujarat is discussed and certain strains from the Kaira district are described.

127. **Hall, A. D.** **634.11:576.356.5**
Research and the breeding of apples. (A lecture delivered at the Bristol meeting of the British Association.)
J. Minist. Agric., 1930, **37**, pp. 765–78.

A brief historical account of apple breeding, followed by a description of the flower and of the conditions of sterility. Certain valuable varieties, notably Cox's Orange Pippin, are self sterile, others comparatively fertile. Some varieties have a very low proportion of good pollen.
A short discussion of the principles of heredity and polyploidy follows. Most apples are diploid with $n = 17$; some are triploid, these being the ones with reduced fertility and vigour of offspring, and hence varieties unsuitable for breeding.
Many anomalies of inheritance have recently been explained by the disclosure that the diploids themselves are derived polyploids from the basic number 7 for the *Rosaceae*.
The bearing of these facts on practical breeding and the theory of evolution is pointed out.

128. **Spinks, G. T.** **634.11:581.162.5**
Self-fertility and self-sterility in cider varieties of apples.
Univ. Bristol Ann. Rept. Agric. & Hort. Res. Sta., 1929, pp. 28–33.

Blossom trusses were enclosed in paper bags at the time of flowering and self-pollination ensured by hand. The number of fruits set was compared with similar trusses left free to normal out-pollination. Almost every variety gave a better set when allowed to open-pollinate; some varieties were almost self-sterile, whilst others shewed a moderate degree of self-fertility.
The times of blossoming of some of the more important varieties are given, the varieties being arranged in groups of those which blossom at the same time.

129. **Tydeman, H. M.** **634.723.1:575.11**
Some results of experiments in breeding black currants. I. The self pollinated families.
J. Pomology & Hort. Sci., 1930, **8**, pp. 106–28.

An examination was made of the progeny of a number of different plants with the object of elucidating their genetic constitution with regard to certain of the more obvious characters. Leaf characters, vigour, bud colour and form, season of coming into leaf, raceme length, quality and cropping of fruit and big bud were studied.
French Black on selfing gave segregation in the first generation for leaf shape, vigour, raceme length; bud colour, form of buds and season of coming into leaf shewed no segregation. The cropping was extremely low. Leaf shape was the only one of the characters to segregate on monohybrid lines.
Seabrook's Black, an entirely similar variety, on selfing shewed variation in leaf shape, giving two different types in addition to those produced from French Black; the numerical results, though small, conformed to a Mendelian two-factor expectation. All these forms were recessive to the normal and the two new types were associated with reduced vigour. Variation also occurred in bud colour and form, raceme length, quality and resistance to big bud. The cropping was in every case very low.
The second generation results are in accordance with the two-factor interpretation of leaf type. The four-leaf types shewed little difference in vigour, but the two new types had shorter racemes and set very little fruit.

These same four types of leaf appeared in the progeny of a wild variety Siberian. The two recessive types had again rather shorter racemes. The progeny also shewed variation in form of buds.
Progenies of four other varieties were similar to that of French Black.
Boskoop Giant, on selfing, gave a progeny uniform for leaf shape, but varied in length of raceme ; the fruits were large or intermediate in size and produced in very small numbers.
Goliath gave a progeny uniform for leaf form, varying in bud colour and shape, and size of fruit. The racemes were shorter than the parent and borne in very much smaller numbers ; very small quantities of fruit were produced.
Baldwin was similar in most respects, the raceme length varying although the length of seedlings was, on the whole, less than that of the parent.
No new combinations of characters having any economic importance appeared in the progenies.

130. **Spinks, G. T.** **634.75:575(42)**
Families of strawberry seedlings bred for resistance to aphis.
Ann. Rept. Agric. & Hort. Res. Sta., Long Ashton, Bristol, 1929, pp. 17–27.
The progeny of a number of Royal Sovereign and other crosses is described with respect to aphis damage, mildew, vigour, time of blossoming, type of flower (perfect and unisexual flowers appearing in equal numbers), yield and size of fruit, as also its colour, shape, firmness, flavour and season.
Certain parents transmitted resistance to aphis, others to mildew and the offspring with desirable combinations of characters have been selected for further propagation.

131. **Lesley, M. M., and Lesley, J. W.** **635.64:576.367.5**
The mode of origin and chromosome behaviour in pollen mother cells of a tetraploid seedling tomato.
J. Genet., 1930, **22**, pp. 419–25.
The F_1 of a cross between a double-trisomic (26 chromosome) x diploid contained diploids, simple trisomics, a trisomic with an additional fragment and one tetraploid which is described. It was fertile, but gave less viable seeds than the diploid ; it grew more slowly. It crossed fairly readily with the diploid, but very few of the seeds germinated.

Part II. Foreign.

STATISTICS (519)

132. **Jorgensen, M.** **519.2:633**
Om Beregning af Usikkerheden paa Forsogsresultater. (The calculation of deviations in experimental results.)
Tidsskr. Planteavl., 1930, **36**, pp. 149–87.
The author concludes that experiments over a large number of years in a limited number of stations are of much greater general importance than those carried out at a large number of stations over a relatively short period.

133. **Swanson, A. F.** **519.2:633.174**
Variability of grain sorghum yields as influenced by size, shape and number of plats.
J. Amer. Soc. Agron., 1930, **22**, pp. 833–38.
The reduction in probable error by increase in plot size rather ceases after 1/25 acre. Long narrow plots were most reliable, those having an area from 1/50 to 1/25 acre and eight rods long being most satisfactory. Two to four replications reduced the probable error to one–three bushels per acre.

134. **Kostecki, E.** **519.251.9:633.63:581.192**
Quelques observations sur la valeur de (m) en tant que mesure de la précision des essais de variétés. (Observations on the value of (m) as a gauge of precision in tests of varieties.)
Bull. Assoc. Internat. Sélect Plantes Grande Culture, 1930, **3**, pp. 36–45.
In a general way, it is considered that the average error of the mean, calculated according to the formula :

$$m = \sqrt{\frac{\Sigma a^2}{n(n-1)}}$$

is the best gauge of the precision of tests.
Dr. Kostecki, by practical examples, points out an error to be avoided when using this formula. Beets, taken from 24 comparative plots, were tested for sugar content, at the rate of about 50 beets per plot. The arithmetic mean of the richness in sugar of the beets taken from the same plot represented therefore the richness of the plot, whilst the average richness of the 24 comparative plots represented the richness of the variety under test.
The author calculates (m) by taking the average of the results obtained by 24 repetitions of $\pm$ 50 roots, and then taking the average of the results obtained by 12 repetitions of $\pm$ 100 roots.
The value of M does not vary, but the average error of the mean (m) is increased by $\pm$ 0,027, which represents 0,137% of M.
It follows therefore that the value of (m) can only be utilized as a gauge of precision of tests in the case of an equal number of determinations or repetitions and that the use of (m) as a comparative standard is not indicative when it is a question of scientific works of different authors having regard to a different number of repetitions.

GENETICS (575)

135. **Roodenburg, J. W. M.** **575:578.082**
Kunstlichtcultuur. (Cultivation of plants in artificial light.)
Laboratorium voor Tuinbouwplantenteelt. Landbouwhoogeschool te Wageningen, 1930, No. 14, 68 pp.
A number of different types of illumination for propagating seedlings in winter were examined. Neon lights, giving an even light of wave length suitable for photo-synthesis, and little production of heat, were very suitable.

136. **Broekema, C.** **575:633**
Plantenveredelingsvraagstukken. I. Algemeen Overzicht. (Plant breeding questions. I. General survey.)
Landbouwk. Tijdschr. Groningen, 1930, **42**, No. 506.
A popular discussion of the present position of plant breeding.

137. **Sirks, M. J.** **575.1**
Desiderata en Consequenties der Moderne Erfelijkheidsleer. (Desiderata and results of the modern genetic studies.)
Vakblad voor Biologen, 1930, **11**, Nos. 6 and 7.
The author remarks that with help of the principles linkage and polymeric factors almost any results can be interpreted and points out the dangers of too ready generalization. He stresses the complete lack of evidence for chiasma and crossing over as assumed by Morgan.
A discussion follows of the interpretation of genetical results on analogy with chemical phenomena and the obvious correlation in certain genetic segregations between the presence or absence of certain genes and the presence or absence of enzymes.
The necessity for linking up the study of genetics with the physiology of developmental processes is emphasized.

138. **Winkler, H.** **575.116.1**
Die Konversion der Gene. Eine vererbungs-theorethische Untersuchung. (The "Conversion" of genes. A theoretical investigation in genetics.)
Gustav Fischer, Jena, 1930, p. 186.
A new theory to explain the facts previously ascribed to the results of crossing over, without the assumption of a uni-dimensional arrangement of genes in the chromosome.

139. **Thompson, W. P.** **575.127:576.312.35**
Causes of differences in success of reciprocal interspecific crosses.
Amer. Nat., 1930, **64**, pp. 405–21.
In making species crosses it is frequently the case that one pair of reciprocal crosses gives much better results than the other, although whatever F_1 plants are obtained are fertile to an equal degree. This has been variously ascribed to morphological peculiarities of the flowers and to a difference in the nature or composition of the protoplasm, to difference of chromosome numbers in the endosperm as in wheat species crosses and wheat x rye or *Aegilops* crosses, where crossing is always more successful when the plant with the greater chromosome number is the female. This is also found to hold for the numerous *Nicotiana* crosses reported in the literature ; and for *Brassica, Linum, Solanum*, and a number of other plants, although certain others afford exceptions. It is thus advisable in making a wide cross to bear this question in mind when choosing the parents.

140. **Kostoff, D.** **575.127.5:633.71**
Tumors and other malformations on certain *Nicotiana* hybrids.
Zbl. Bakt., 1930, **81**, pp. 244–60.
Hybrids between certain species developed cancerous proliferations to such an extent that the plants died, whereas the hybrids between other combinations of species were quite normal. All intermediate conditions existed.
The tumors resemble those produced by *Bacterium tumefaciens* and those formed in certain interspecific and intergeneric grafts.
In a family produced from a backcross, it was noticed that those plants which were, in respect of other characters, most heterozygous displayed the greatest tumor development.
The tumors were proved not to be due to any bacteriological infection, and it is supposed that they are caused by foreign substances introduced from the unrelated parent, in the same way that a number of chemical agents are known to bring about tumor formation.
Plants of a morphologically pure line may differ in precipitin formation, and this is taken as the explanation of the fact that different crosses involving the same species are characterized by different degrees of tumor formation.

It is supposed that the " formative substances " of each parental species are different, and in some cases tend towards different types of development, with the result that anomalous growth processes such as tumors set in.
Certain chromosome irregularities and phenomena of polyploidy were observed in the cells of the tumors.

141. **Stubbe, H.** **575.243**
Untersuchungen über experimentelle Auslösung von Mutationen bei *Antirrhinum majus. I.* (Researches on the experimental liberation of mutations in *Antirrhinum majus. I.*)
Z. indukt. Abstamm—u. Vererb Lehre., 1930, **56**, pp. 1–38.
The developing flower buds of *Antirrhinum* were exposed to varying amounts of X-rays and ultra-violet light and to sudden changes of temperature. Seedlings were also centrifuged in various chemical solutions. As a result, five groups of well defined mutations were observed in the plants derived from these treated flowers. The same types of mutation occurred whatever the treatment.
(1) Dwarf plants.
(2) Narrow-leaved plants.
(3) Plants with a one-sided leaf blade development.
(4) Other leaf and flower abnormalities, such as variegated leaves, rounded and leathery leaves.
(5) Plants at first phenotypically normal, but with very reduced fertility, especially ♂.

142. **Patterson, J. T., and Muller, H. J.** **575.243:537.531**
Are " Progressive " mutations produced by X-rays?
Genetics, 1930, **15**, pp. 495–589.
The authors conclude that progressive mutations can be induced by X-ray treatment if they are capable of occurring. The fact that mutations in both directions occurred at a particular locus in Drosophila proved that mutations induced by X-rays are not merely " losses."

143. **Baur, E.** **575.243:537.531**
Die Auslösung von Mutationen durch chemische und physicalische Reize und ihre Bedeutung für die Pflanzenzüchtung. (The production of mutations by chemical and physical irritation, and its importance in plant breeding.)
Zbl. Zuckerind., 1930, **38**, Festausgabe, p. 577.
The mass of information on hereditary variation has so far been obtained from hybridization; combinations of desirable features have been made by crossing different species. By such means new combinations of existing characters can be made, not new characters. These are frequently produced by mutation. Man has therefore long striven to produce these mutations experimentally and success was first attained with lower organisms, bacteria and fungi. Elevated temperatures next brought about an increase in the mutation rate in certain animals, but the first really great increase in the number of mutations was obtained by irradiation in *Drosophila* by Muller about four years ago. As many as 75% of the sex cells mutated, giving mutants similar to those known from spontaneous mutation, and also some entirely new.
With plants E. Stein first got a series of abnormalities in dandelion as the result of radium treatment; these were quite distinct from the spontaneous mutations known and were not Mendelian; the alteration was evidently in some other organ than the chromosomes.
Mutations can also be produced by various chemical stimuli.
If young seeds, just germinating, or just swelling even, are subjected to X-rays, high or low temperatures, or certain poisons, the plant produced shews no change but its progeny shews a great difference in hereditary characters. About 600 such mutations were produced last year, displaying a whole series of gene changes.
It is interesting to note that a plant subjected to comparatively weak treatment is itself not changed, but the next generation shews a great variety of mutations. For instance, in 1927 a large number of plants of a pure, quite constant line, were put at the stage of 10cm. height, in a particular poison in 10% alcoholic solution, or in chloral hydrate or the like, and subjected to

151. **Fruwirth, C.** **633:575**
Allgemeine Züchtungslehre der landwirtschaftlichen Kulturpflanzen. (Breeding agricultural crops in general.)
Handb. landwirts. Pflanzenz., Paul Parey, 1930, Vol. 1, 498 pp.
The seventh edition of this work, extended and brought up to date.

152. **East, E. M.** **633:575.143:575.12**
The production of homozygotes through induced parthenogenesis.
Science, 1930, **72**, pp. 148–9.
A number of diploid plants obtained from wide crosses were pure for the characters expected in the female gametes. They must have arisen by parthenogenesis from haploid cells during the development of which diploidy ensued. They were therefore completely homozygous.
If this method of producing homozygotes can be applied to other plants, it will be of great practical importance.

153. **Goodspeed, T. H., and Avery, P.** **633:575.243:576.312.36:537.531**
Nature and significance of structural chromosome alterations induced by X-rays and radium.
Cytologia, 1930, **1**, pp. 308–27.
The gene mutations induced artificially have led to the suggestion that natural radiation represents a major factor in the evolutionary mechanism.
The various types of chromosome irregularities which may result from irradiation are described and illustrated in some detail. Many of the morphological and other variations arising from irradiation are ascribed to these chromosome irregularities, others appear to be definitely gene mutations.
At least two stable derivatives of *Nicotiana tabacum* have emerged, evidently resulting from induced reorganization of the chromosomal, and hence genetic, material. The high degree of viability of the aberrant forms appears to be associated with the polyploid nature of *N. tabacum* and the authors consider that the question is assuming a great practical importance.

154. **Zeigler, O.** **633:575.42**
Kritische Betrachtung zur Auslesezüchtung. (Critical examination of breeding by selection.)
Z. Züchtung, 1930, **A. 15**, pp. 167–218.
Emphasis is laid on the difference in aims and methods of the plant breeder and the pure geneticist. A note of warning is sounded, pointing out that if the breeder follows too closely the methods of the latter, there is the risk of failure in the main object of breeding, namely to improve the value of the local crops in all agronomic respects.

155. **Hijhouwer, A. P. C.** **633:575.74**
Over het vraagstuk der "veroudering" ten gevolge van langdurig voortgezette, ongeslachtelijke vermeerdering. (On the question of senility as a result of continued vegetative propagation.)
Med. v. d. Landbouwhoogesch. te Wageningen, 1930, **34**, (4) 119 pp.
The author concludes that it is still doubtful whether any attention need be paid to senility in dealing with vegetatively propagated plants.

156. **Maximov, N.** **633–2.111**
L'état actuel de la question de la résistance des plantes au froid et les méthodes modernes de sa détermination. (The present state of the question of the resistance of plantes to cold and modern methods of its determination.)
Bull. Assoc. Internat. Sélect. Plantes Grande Culture, 1930, **3**, pp. 95–106.
Results obtained by the method of direct freezing in a specially constructed cold chamber accord very closely with those given by determining the sugar content chemically or by use of the refractometer or dilatometer. The tests were made on 64 varieties of winter wheat, rye and barley and were fully in accord with those from field trials over a number of years.

These laboratory researches expedite plant breeding work as the methods outlined above can be satisfactorily substituted for long field trials.

157. **Köhler, E.** **633–2.4–1.521.6:575**
Die Immunitätsfrage im Lichte neuer Forschung. (Breeding for immunity in the light of recent research.)
Mitt. deuts. landw. Ges., 1930, **45**, pp. 687–9 and 709–11.
A discussion of the various factors involved in resistance to disease, morphological, chemical, physical (osmotic pressure, etc.), the varying susceptibility of varieties, the formation of toxic substances, physiologic forms, and the origin of new forms by hybridization and mutation. The fact that so many varieties have retained their resistance over such long periods and the very fact that the parasitism of the fungi is so limited, and that the further multiplication of the fungi is reduced by the culture of resistant varieties, gives the author confidence that this is a sure way of combating disease. The greater difficulty of breeding varieties resistant to a comparatively little specialized parasite is pointed out.
The author stresses the importance of wild forms from which genes for resistance can be introduced by hybridization into cultivated forms. Müller has successfully accomplished this in potatoes and American and Canadian workers in wheat, in the latter case introducing factors from the emmer group which promise full resistance in the mature plant stage to all rust forms, thus greatly reducing the menace of new forms originating by hybridization and mutation.

158. **Tavcar, A. von** **633.1–2.111**
Bestimmung der Winterfestigkeit bei Getreidepflanzen. (The determination of the resistance offered by cereals to the cold.)
Bull. Assoc. Internat. Sélect. Plantes Grande Culture, 1930, **3**, pp. 107–112.
The various methods for determining the cold resistance of cereal plants are briefly discussed. A method originated by the author is described in which the position of the vegetative point is taken as an indication of cold resistance In a number of tests with spring and winter wheat, winter and spring barley and oats, the most resistant types were seen to be those whose main vegetative point was most deeply buried.
Oats, which are relatively less hardy, have their vegetative point higher than the other two.

159. **Havas, G.** **633.11durum:575**
Versuchsergebnisse über das Züchten des Hartweizens. (The results of investigations on the breeding of hard wheat.)
Rep. Hung. Agric. Expt. Stas., 1930, **33**, p. 42.
Production of a winter-sown durum wheat which withstood 20–25° C. without serious injury. Appearance of vulgare mutations among the durum wheats.

160. **Nakamura, S.** **633.11:575.1–181.13**
On the inheritance of dwarfness in wheat.
J. Sapporo Soc. Agr. & For., 1930, **22**, pp. 52–74.

161. **Kihara, H.** **633.11:575.11**
Genomanalyse bei *Triticum* und *Aegilops*. ("Genom" analysis in *Triticum* and *Aegilops*.)
and Nishiyama, I.
Genomaffinitäten in tri-, tetra- und pentaploiden Weizenbastarden. ("Genom" affinities in tri-, tetra- and pentaploid wheat hybrids.)
Cytologia, 1930, **1**, pp. 263–70 and 270–84.
Kihara in his introduction describes the cytological and genetical methods and material necessary for a "genom" analysis. By "genom" is meant a single chromosome set which may be multiplied in polyploidy.

In the second part of the paper, the behaviour of the chromosomes of various wheat hybrids is described. The F1 of *T. aegilopoides* x *T. dicoccum* and *T. dicoccum* x *T. monococcum* showed the following combinations among the chromosomes at meiosis :—

$7_{II} + 7_I$
$1_{III} + 6_{II} + 6_I$
$1_{III} + (1_{II} + 1_{II}) + 4_{II} + 6_I$
$2_{III} + 4_{II} + 7_I$
$3_{III} + 3_{II} + 6_I$

of *T. spelta* and *T. aegilopoides* :—

$(1_{II} + 1_{II}) + 5_{II} + 14_I$
$1_{III} + 5_{II} + 15_I$
$2_{III} + 4_{II} + 14_I$
$1_{III} + 7_{II} + 11_I$
$10_{II} + 8_I$
$7_{II} + 14_I$

and of *T. durum* x *T. vulgare* :—

$13_{II} + 9_I$ (rare)
$14_{II} + 7_I$ (common)
$1_{III} + 13_{II} + 6_I$
$2_{III} + 12_{II} + 5_I$

The fertility of the tetraploid hybrids was found to be higher than that of the triploid. The bearing of the results on the affinities of the various " genoms " is discussed.

162. **Liepin, T.** **633.11:575.113.42:581.46**

Inheritance of quantitative characters in *durum* wheats. II. Inheritance of the length of apical tooth in a *Triticum durum* x *Triticum persicum* cross.
Bull. Bur. Genet., 1930, No. 8, pp. 19–45.

A cross involving " shift " as previously reported by other authors was examined. The results were treated biometrically. The F1 was intermediate, whilst the F2 gave a very complicated segregation, the parental types only rarely being approached. The " shift " as reported by Vavilov in this cross was not observed.
In F3 40 families were examined. There were nine groups of families in relation to the limits of variation of the length of tooth and to its mean length. Both the extreme groups, each consisting of one family, were similar to the parental forms.
Twenty-nine F4 families were also studied. All families were segregating and new forms not previously met with appeared in which the parental limits were transgressed.
It is evident that a number of factors influence the length of tooth, short tooth being dominant. The number of length groups was 13 in all, which is an indication that six pairs of factors were operative ; the transgression of the parental limits shews that the *durum* parent was recessive for one factor pair and the *persicum* parent was dominant for one pair. The results further indicate that the factors were unequal in their effect.
The author considers that the explanation of the phenomenon of shift lies in multiple factors.

163. **Philiptschenko, J.** **633.11:575.116.1:581.46**

Again on the question of genes and the development of the form of ear in wheat.
Bull. Bur. Genet., 1930, No. 8, pp. 1–18.

A revision of the statements made in 1929 papers.
The genes are placed in two groups, the powerful genes, *C* (*Compactum* factor) and *S* (*Spelta* factor), and the less powerful, squarehead genes. The action of the genes *S* and *C* can be observed when about 80% of the process of ear development has been accomplished.
Two independent genes for squareheadedness are recognized, *k* and *q*. The *k* factor causes squareheadedness in *vulgare* types, *q* in *compactum* types. The latter gene is linked with *n* for presence of awns, with a linkage ratio of *ca* 30%.

Squareheaded *compactum* types almost resemble the " *compressum* " types, which are supposed to possess still another gene—*r*. The *k* factor is manifested two days before earing, and *q* and *r* directly before earing.

Ear differences between related forms are of two kinds : those which are manifested late in development and are evidently determined by definite genes, and those appearing at the beginning of development which determine the peculiarities of different genera. The latter type of difference is said to depend on a definite constitution of the protoplasm (" Plasmon ") rather than on special genes.

164. **Tschermak, E.** **633.11:575.127**
Ueber seltene Weizen- und Haferbastarde und Versuche ihrer praktischen Verwertung. (On unusual wheat and oat hybrids and experiments on their practical application.)
Beitr. Pflanzenz., 1929, No. **10**, pp. 74–93.

First the conditions necessary for effecting the cross are described. The time of flowering of the two parents, the temperature and moisture conditions, and the choice of the parent plants are of particular importance. Certain strains, and even certain individuals, will succeed when others will not. Furthermore, the direction of the cross is of great importance, reciprocal crosses being by no means alike.

The results of various authors in making combinations of various species are described, emphasis being laid on those of practical importance.

Attention is called to the combination of rust resistance and *vulgare* characteristics in certain *durum* x *vulgare* crosses, and the spontaneous production of wheat-rye hybrids which, by suitable backcrossing, have given constant early, winter-hardy forms, some of which had good baking quality. Certain of the author's own are described, *e.g.* a constant type obtained by continued selection of the progeny of a wheat-rye cross ; it was fully fertile and of the wheat type, having a strong resemblance to *T. circumflexum*. Others of the author's wheat-rye-rye hybrids were fully fertile, very early and absolutely winter-hardy. All that now remains is to test their yield.

The constant 28 chromosome *Aegilotricum* with its large grains is useless in practice owing to the shedding of the grains at maturity. There remains the possibility of selecting a useful type from the progeny of the backcross with wheat. A number of other combinations involving *Aegilops* are illustrated ; some of these combine the three genera—*Aegilops-Triticum-Secale*.

A brief reference is made to the author's crosses of *Avena fatua* and *A. sterilis* x *A. sativa* and the linkage of certain of the parental characters. Shedding of the grain, one of the characters of the wild forms, is linked with full awning and hairiness of the glumes of the two lower florets ; and no union could be effected between the wild character hairiness of the paleae and the yellow palea colour of the cultivated type. In crosses of *A. fatua* x *A. sterilis* the characters of the latter were completely dominant.

Some of these oat crosses may have a practical importance in introducing winter-hardiness and certain other characters into cultivated forms.

165. **Kihara, H., and Nishiyama, I.** **633.11:575.127.2**
Genomaffinitäten in tri-, tetra- und pentaploiden Weizenbastarden. (" Genom " affinities in tri-, tetra- and pentaploid wheat hybrids.)
Cytologia 1930, **1**, pp. 270–84.
See No. 161 above.

166. **Thompson, W. P., and Robertson, H. T.** **633.11:575.127.2:576.312.36**
Cytological irregularities in hybrids between species of wheat with the same chromosome number.
Cytologia, 1930, **1**, pp. 252–62.

In view of the hypotheses of Huskins and Malinowski on the chromosomal differences between the different wheat groups, it was desirable to determine whether the chromosomes of each species are completely homologous with those of all other species of the same chromosome group. Crosses were made in all combinations within each group and compared with the pure species.

Univalents were observed in *vulgare* x *spelta*, *vulgare* x *compactum*. Similar irregularities occurred to a certain degree in the crosses made within the emmer group. Crosses involving Khapli were the only ones which displayed at all a high amount of irregularity.
On the whole the evidence indicated that differences between the species exist in the gene complexes within the chromosome and are usually not so great as to prevent the mating of the chromosomes.
There was no evidence of the association of non-homologous chromosomes.

167. **Stevenson, F. J.** **633.11–2.452–1.521.6:575.127.2**

Genetic characters in relation to chromosome numbers in a wheat species cross.
J. Agric. Res., 1930, **40**, pp. 161–79.

Genetic and cytologic studies were made of the F_1, F_2 and F_3 generations of a cross between *T. vulgare Host.* and Velvet Don (*T. durum*) which is highly resistant to *Puccinia graminis tritici* and *P. triticina* in the field, although quite susceptible to all forms of the former in the seedling stage under artificial inoculation.
The F_1 had 35 chromosomes, 14 bivalents and seven univalents. Seed was set to the extent of 5%. Frequent end-to-end pairing of some of the bivalents was observed. Five F_2 plants had 42 chromosomes, 11 had 28 and a small number had intermediate numbers. Three of the 42 chromosome plants had as many as three of the *durum* characters, the remaining two had two ; the 28 chromosome plants shewed a tendency to be *durum*-like, although one was *vulgare*-like for all characters.
The F_3 of one of the 42 plants was examined. The 13 plants were all 42. Segregation occurred for keel, collar, glume shape and seed colour. All were susceptible to leaf rust but segregated for resistance to stem rust, although all were more resistant in the field than the *vulgare* parent. There was no association between rust resistance and *durum* characters and one plant combined the *vulgare* characters with the stem-rust resistance of the *durum* parent and was very fertile. Another plant combined the *vulgare* characters with the stem-rust and part of the leaf-rust resistance of the *durum*.
Other F_3 families behaved similarly in these respects. One plant exhibited the leaf-rust resistance of the *durum* parent, but no plant had the combined leaf and stem-rust resistance of the parent ; this could be built up, however, by intercrossing these hybrids.
F_2 plants of intermediate chromosome number shewed irregularities in metaphase ; many end-to-end bivalents, trisomes and other irregularities were observed. One 34 plant was almost sterile.
Families of lower chromosome number and *durum* characters were found which were almost all as susceptible as the *vulgare* parent.
All the F_2 plants with 14 pairs of chromosomes gave F_3 lines with 14 chromosome pairs and all the *durum* characters. Four out of eight plants shewed the *durum* type of leaf-rust reaction, others were intermediate ; reaction to stem-rust varied from resistance to susceptibility.
Several sterile plants had more or less normal chromosome numbers such as are usually associated with complete fertility. This is further evidence that not only the number but the nature of the chromosomes is concerned in the production of sterility or fertility.
The main object of this work was to shew that *vulgare*-like segregates could be obtained with the rust resistance of the *durum* parent.

168. **Kihara, H., and Wakakuwa, S.** **633.11:575.127.2–181.13:576.312.35**

Dwarf plants with 40 chromosomes in the progenies of a pentaploid *Triticum* hybrid.
Jap. J. Genet., 1930, **5**, pp. 134–37.
Paper written in Japanese.

169. **Delaunay, L.** **633.11:575.243:537.531:576.312.36**
Die Chromosomenaberranten in der Nachkommenschaft von röntgenisierten Aehren einer reinen Linie von *Triticum vulgare albidum* All. (The chromosome aberrations in the progeny of X-rayed ears of a pure line of *T.v.a.*A.)
Z. indukt. Abstamm.—u. Vererb. Lehre, 1930, **55**, pp. 352–55.
Certain lines of wheat were subjected to dosages similar to those given by Muller in the case of *Drosophila*. Many ears were quite sterile. There were six clear mutations, with spelt-oid characters, and lacking one or two or portions of chromosomes. Certain others were modified in other respects, one being very strong growing, dark green and four days earlier in ripening.

170. **Sapěhin, A. A.** **633.11:575.31**
Röntgen-Mutationen beim Weizen (*Triticum vulgare*). (Röntgen mutations in wheat (*Triticum vulgare*).)
Der Züchter, 1930, **2**, pp. 257–59.
The following treatment gave the greatest effects: 130 *K V* max., 5m. *A*, 30cm. distance, 1mm. aluminium filter, and a 20–30mins. exposure on wheat ears before blooming. A surprising number of mutations occurred among the progeny. Most, but not all, were chromosome aberrants and mostly more or less sterile. Many were morphologically defective. The investigations are being continued.

171. **Schnyder, A.** **633.11:575.42(44)**
Considérations techniques sur la culture des céréales en France. (Technical considerations on the culture of cereals in France.)
Ann. agric. Suisse, 1930, No. 4, pp. 435–45.
A brief account of the work of the Institut de Recherches Agronomiques, Maison Vilmorin and certain other firms in cereal improvement by selection of hybrid material.

172. **Raum, H.** **633.11:576.16**
Ueber die geographische Verbreitung der Erbeinheiten des Weizens und ihre Bedeutung für die Ernährung der Völker. (On the geographical distribution of the genetic units of wheat and their importance in the maintenance of the people.)
Fortschr. d. Landwirts., 1930, **5**, pp. 1–11.
A discussion of the various questions relating to the origin and distribution of the different wheat forms.

173. **Bleier, H.** **633.11:576.354.46:581.036**
Experimentell-cytologische Untersuchungen. I. Einfluss abnormaler Temperatur auf die Reduktionstellung. (Experimental cytological investigations. I. Influence of abnormal temperature on reduction division.)
Zeitschr. f. Zellforschung und mikros. Anatomie, 1930, **2**, pp. 218–36.
Wheat plants were subjected to high and low temperatures at the time of the pollen formation. Diploid and tetraploid nuclei and other irregularities appeared.

174. **Dusseau, A.** **633.11:581.45**
Sur la chlorophylle des feuilles de blé. (On the chlorophyll of the leaves of wheat.)
C.R. Acad. Sci. Paris., 1930, **190**, pp. 68–70.
The writer shews that wheat varieties may be identified by the alcoholic chlorophyll extract of their leaves.

175. **Buchinger, A.** **633.11:581.48:576.341:664.641.016**
Vererbungsstudien über die Glasigkeit und Mehligkeit beim Weizen und deren Beziehungen zur Saugkraft. (Inheritance studies on vitreous and starchy kernels in wheat and their relations to osmotic pressure.)
Fortschr. d. Landw., 1930, **5**, pp. 131–32.

The progeny of kernels grown separately shewed the same proportions of vitreous and starchy kernels as the plants from which they were derived.
Plants from kernels with high osmotic pressure were more cold-resistant and produced a higher proportion of vitreous kernels.

176. **Balde, H.** **633.11–2.111:581.912**
Vergleichende chemische und refractometrische Untersuchungen an Weizenkeimlingen unter Berücksichtigung der Frosthärte der untersuchten Sorten. (Comparative chemical and refractometric investigations on wheat seedlings in connection with their frost resistance.)
Angew Bot., 1930, **12**, pp. 177–212.
The sugar content of young wheat plants grown in the dark under varying conditions was estimated chemically. The results were compared with the frost resistance and only agreed when the plants were grown round about 0° C. and even then there was not a very close agreement.

177. **Kienholz, J. R., and Heald, F. D.** **633.11–2.451.3:576.16**
Cultures and strains of the stinking smut of wheat.
Phytopathology, 1930, **20**, pp. 495–512.
A few years ago collections of smut were obtained which attacked certain forms hitherto immune. Physiologic forms of *Tilletia tritici* and *T. levis* have been demonstrated and this paper is a contribution to the methods of investigating them.

178. **Scheibe, A.** **633.11–2.452 P. triticina:576.16**
Studien zum Weizenbraunrost, *Puccinia triticina* Erikss. III. Über die geographische Verbreitung der einzelnen physiologischen Formen und Formenkreise in Deutschland und in seinen angrenzenden Gebieten. (Studies on brown rust of wheat. III. On the geographic distribution of the individual physiologic forms and groups of forms in Germany and the neighbouring districts.)
Arb. Biol. Reich. Land. Forstw., 1930, **18**, pp. 55–82.
After a description of the frequency and distribution of the brown rust forms in Germany in the years 1927 to 1929, the author goes on to discuss their significance. Two distinct groups differing in reaction occur, one in the East and one in the West, including the countries near the borders. The forms from the East attack the standard wheat varieties much more seriously than the westerly forms and display a greater degree of specialization. The countries in the S. East of Europe regularly suffer very severe attacks of this parasite. It is pointed out that this is the rust which best resists drought and cold and which flourishes in the higher summer temperatures associated with these regions and that the alternate host, *Thalictrum*, is more plentiful here. The importance of these discoveries in breeding for rust resistance is pointed out.

179. **Scheibe, A.** **633.11–2.452 P. triticina:576.16:575**
Studien zum Weizenbraunrost, *Puccinia triticina* Erikss. II. Über die Anfälligkeit von Weizensorten gegenüber verschiedenen Braunrost-biotypen in den einzelnen Entwicklungsstadien der Wirtspflanzen. (Studies on brown rust of wheat, *Puccinia triticina* Erikss. II. On the susceptibility of wheat varieties towards various brown rust biotypes in the individual phases of development of the host plant.)
Arb. Biol. Reich. Land. Forstw., 1930, **17**, pp. 549–86.
The specialization is manifested over the whole life period of the host plant. The intensity of the infection is greater in the young parts of the plant but the characteristic type of infection undergoes no change. Tests of seedling reaction to this rust thus give entirely reliable results although in genetic material it is advisable to make observations also on the mature plant.

180. **Coleman, D. A., and collaborators** **633.11:664.641.016**
Milling and baking qualities of world wheats.
Tech. Bull. U.S. Dept. Agric., 1930, **197**, 223 pp.
An account of the wheat production of all the important countries of the world, and of the quality of the product, based on a large number of tests and analyses of different constituents.

181. **Fedorova, N.** **633.13:575.11:575.127.2**
Hybridization of *Avena sativa* with *Avena fatua*. I. Qualitative characters.
Bull. Bur. Genet., 1930, No. 8, pp. 47–61.
The F 1 was intermediate in all characters. An examination of F 2 and F 3 led to the conclusion that the wild species differed from the *sativa* in the genes *A-a*, the dominant *A* being characteristic of *sativa*. The following characters were determined by these genes : base of grain, awns, pubescence of base of grain, and of pedicel. Two modifiers are also present for pubescence of base of grain.
Pubescence on the back of the grain was determined by two factor pairs, *B-b* and *C-c* ; *BB* causes pubescence on the back of lower grain, *cc* on the back of upper grain.
Grain colour is due to two factor pairs, *N-n* and *S-s*, *NS* giving black, *Ns* brown, *nS* grey and *ns* yellow. Genes *N* and *B* are coupled.

182. **Coffman, F. A., and Wiebe, G. A.** **633.13:575.125**
Hybrid vigor in oats.
J. Amer. Soc. Agron., 1930, **22**, pp. 848–60.
The characters plant height, panicle length, number of culms, total plant weight, straw weight, grain weight and date of heading of the F 1 hybrids of various varieties of oats were compared with the average means of their parents. Grain weight showed the most significant increase in the majority of the hybrids and was maintained to a less extent in F 2. Plant height increased slightly in most crosses and total plant weight showed on the average a barely marked increase. The date of heading in all but four cross was earlier than the parents. Much variation was shewn by the other characters studied.

183. **Nilsson, N. H.** **633.13:575.24**
Sind die Mutierenden reinen Linien auch Rein ? (Are mutating pure lines really pure ?)
Hereditas, 1930, **14**, pp. 33–49.
The author takes for his study a variety of black oats which has been known to give white " mutants." The white seeds produced plants giving lower yields than the normal, but their vitality was no less, as shewn by normal F 2 ratios, when crossed with a black form. Certain lines gave no white grains, whereas one gave as many as 1 in 120. When black grains of these two lots were separately propagated in the following years, the results were repeated, the former line giving only 1 in 6,000 of white grains. There seemed to be lines intermediate between these two. These differences were statistically significant. The white grains are regarded therefore not as mutations, but as the result of segregation in a line which originally was not pure for this character. An alternative explanation is that the original lines were periclinal chimaeras.

184. **Reed, G. M.** **633.13–2.451.2:576.16**
New physiologic races of oat smuts.
Bull. Torrey Bot. Club, 1930, **56**, pp. 449–70.
Eleven distinct races of loose smut and five of covered smut exist. Very few oat varieties are resistant to all races. *A. brevis* is resistant to all of the former and somewhat susceptible to the latter. Black Mesdag and Markton are resistant to all.

185. **Tedin, O.** **633.13–2.452:576.16(48.5)**
Till frågan om havresvartrostens mångformighet i Sverige. (On the question of the existence of different forms of oat rust in Sweden.)
Sverig. Utsädesfören. Tidskr., 1930, **40**, pp. 111–14.
Four forms were made evident by infection tests of four oat varieties. A number of endemic oats and new hybrids all proved susceptible to one or other of these rust forms.

186. **Frenzel, H.** **633.13-2.452-1.521.6**
Beiträge zur Spezialisierung des Haferkronenrostes, *Puccinia coronifera f. sp. avenae* Kleb. (Contribution to the specialization of crown rust of oats, *P. coronifera f. sp. avenae* Kleb.)
Arb. Biol. Reich. f. Land. Forstw., 1930, **18**, pp. 153–76.
One variety only, Ruakura, was resistant to all forms of the rust with the exception of form 20. A number of other varieties were partially resistant. All species of *Avena* have susceptible and resistant varieties.

187. **Ossent, H. P.** **633.14:575"793"**
Perennierender Kulturroggen. (Perennial rye.)
Der Züchter, 1930, **2**, pp. 221–27.
A perennial rye would have great cultural advantages. Wild forms, however, are deficient in quality and the ears shatter at harvest. In 1927, crosses were made of *Secale cereale* with *S. montanum* and *S. anatolicum*. The F_1 was of intermediate type, but with brittle rachis; very few plants remained alive after the third harvest.
In F_2 75% of the plants had perennial habit and brittle rachis, only 1% had perennial habit and tough rachis. The remaining plants were intermediate. Segregation occurred also for habit, type of ear, size and quality of grain.
The F_3 contained many more plants with the desired ear type and it is hoped that valuable types may be secured by rigorous selection among the mass of different types which appeared.

188. **Baltzer, U.** **633.14-2.484**
Untersuchungen über die Anfälligkeit des Roggens für Fusariosen. (Investigations on the susceptibility of rye to Fusarium.)
Phytopath. Zeits., 1930, **2**, pp. 377–41.
There was very little difference in susceptibility between the varieties, and selection for resistance had little effect.

189. **Singleton, W. R., and Jones, D. F.** **633.15:575.116.1:581.162.52**
Heritable characters of maize. XXXV. Male sterile.
J. Hered., 1930, **21**, pp. 266–68.
A character, ms_1, for complete sterility of the male tassel, was found to be very closely linked with *y*, white seeds, and the other characters in this linkage group. The data are insufficient to determine the exact position of the character in the linkage group. The character is shewn to be a single Mendelian unit.
The character may have a commercial value in obviating the necessity for detasseling in the production of crossed seed.

190. **Fleischmann, R.** **633.15:575.12**
Befruchtungsergebnisse bei Mais zu verschiedenen Tageszeiten. (Fertilization results with maize at different times of day.)
Z. Züchtung, 1930, A. **15**, pp. 298–305.
The most favourable time for pollination is early morning, becoming less and less so as the day progresses.

191. ***Hayes, H. K., Brewbaker, H. E., and Immer, F. R.** **633.15:575.125**
Double-crossed corn in Minnesota.
Minn. Agric. Expt. Sta. Bull., 1930, **260**, 16pp.

192. **Kiesselbach, T. A.** **633.15:575.125**
The use of advanced-generation hybrids as parents of double-cross seed corn.
J. Amer. Soc. Agron., 1930, **22**, pp. 614–25.

* Summary to appear in a future issue.

The author found that almost as good results were obtained by crossing the F_2, F_3 or later generations of two crosses together, rather than the F_1's in the commonly accepted method of the double-cross for restoring the vigour of self-fertilized lines.

193. **Hayes, H. K.** **633.15:575.125**
The commercial use of double-crossed corn in Minnesota.
J. Amer. Soc. Agron., 1930, **22**, pp. 606–13.
The methods of crossing selfed lines and of crossing the resulting plants again in the double-cross method are referred to. Some of these double-cross lines are superior to either of the original types.

194. **Hume, A. N.** **633.15:575.42**
The possibility of utilizing selfed strains in practical corn improvement.
Bull. S. Dak. Agric. Expt. Sta., 1930, **245**, p. 22.
The Ohio system of selection gave better and more rapid results than the ordinary mass selection methods. Strains so procured were capable of serving as parents for crossing when hybrid vigour was desired. A method of ear-row selection followed by systematic crossing for hybrid vigour is outlined.

195. **Beadle, G. W.** **633.15:576.354.46:575.11**
Genetical and cytological studies of Mendelian asynapsis in Zea mays.
Mem. Cornell Agric. Expt. Sta., 1930, **129**, 23 pp.
Asynaptic plants are characterized by a failure of the usual pairing of homologous chromosomes during meiosis. Such plants display a high degree of male and female sterility.
The character behaved as a simple recessive in five successive generations. The process of meiosis during microsporogenesis is described and figured. At metaphase I, 20 univalents are usually present in place of the normal 10 bivalents. Sometimes one or more bivalents occur. Several spindles are frequently seen, with corresponding irregularities of cell formation. No functional pollen has been obtained from asynaptic plants.
Unreduced megaspores, and it is supposed also microspores, are formed, and as a result of pollination by normals, plants whose behaviour indicate them to be triploids have been produced. Well-developed kernels were associated with diploid embryos and poorly-developed kernels with triploid. Triploid embryos were also smaller than diploids, although the triploid plants were vegetatively vigorous ; there is evidence that the small size and poor initial development of the triploids is resultant upon the ill-developed (pentaploid) endosperm rather than any inherent defect.
Intermediate chromosome numbers were strikingly few. On the other hand, the similarity of these phenomena to those commonly associated with wide hybrids shews the danger of using such behaviour as a criterion of hybridity.

196. **Mangelsdorf, P. C.** **633.15:581.142:575**
The inheritance of dormancy and premature germination in maize.
Genetics, 1930, **15**, pp. 462–94.
Nine different types of premature germination are described involving at least 15 different genetic factors. These may be complementary or duplicate, triplicate and quadruplicate. Linkage may occur with about 33% crossing-over. The theory of duplicate factors is discussed.

197. **Ranker, E. R.** **633.15–2.451.2–1.521.6**
The nature of smut resistance in certain selfed lines of corn as indicated by filtration studies.
J. Agric. Res., 1930, **41**, pp. 613–19.
Juice from the whole plant in resistant and susceptible varieties was equally favourable as a germination medium for smut spores. However, when juice from husks, leaves and stalks was used, it had a marked inhibiting power in the case of certain resistant varieties and not in the case of susceptible varieties. Certain resistant varieties did not give this reaction, indicating that other factors are also concerned in resistance.

198. **Kyle, C. H.** **633.15–2.451.2–1.521.6:575.125**
Relation between the vigor of the corn plant and its susceptibility to smut (*Ustilago Zeae*).
J. Agric. Res., 1930, **41**, pp. 221–31.
Lines which had been selfed for 6 to 11 years were compared with F 1 crosses between them, in the case of two resistant lines and of two susceptible lines. The F 1 cross of the resistant lines was 1.3% more smutted than the more susceptible of the two parents, whilst the F 1 cross of the two susceptibles was 10·7 more smutted. In each case the F 1 was also more vigorous.
The number of smut galls per 1,000 plants was taken for all lines and for plants of the F 1 crosses ; this was found to be in the same order as the daily increase in plant weight with very few exceptions, shewing again a close association between vigour and susceptibility.
The increase in vigour of the F 1's over that of the parents was inversely proportional to the vigour of the parent lines and the relative numbers of smutted plants in the crosses were in the same order, still further demonstrating the association of smut infection with increased vigour.
The crosses from the susceptible group averaged considerably more grain (13·2%) than those of the resistant group.
Reduced vigour resulting from unfavourable environment was also shewn to be accompanied by increased resistance.
The danger is pointed out of reducing vigour and yield by selecting for smut resistance.

199. **Kuckuck, H.** **633.16:575**
Die Genetik der Gerste. (The genetics of barley.)
Der Züchter, 1930, **2**, pp. 50–60.
A general review with a good bibliography.

200. **Robertson, D. W., and Deming, G. W.** **633.16:575.061.6**
Genetic studies in barley.
J. Hered., 1930, **21**, pp. 283–88.
A chlorina seedling which grew to maturity was found among Colsess barley and a yellow, a white and a virescent seedling were found in Coast barley.
The heterozygous, and where possible, the homozygous, forms were intercrossed and all showed independent inheritance. Yellow, chlorina and virescent were independent of the factor pair hoods *v.* awns.
Three factors are involved in the cross between the smooth style of Lion and the feathery style of Coast.

201. **Ghimpu, V.** **633.16:576.3**
Recherches caryologiques sur les genres *Hordeum, Acacia, Medicago, Vitis* et *Quercus*. (Caryologic researches on the *genera Hordeum, Acacia, Medicago, Vitis* and *Quercus*).
Arch. Anat. micro., 1930, **26**, No. 2.
The chromosome number in the cultivated races of *Hordeum sativum* has been found to be invariably 14 (2*n*) but some of the wild species have 28. The size and form of the chromosomes in the different species is described, also the behaviour of the chromosomes on division, occurrence of satellites, etc. The other *genera* were studied on similar lines.

202. **Kuckuck, H.** **633.16:576.312.32:575.116.4**
Versuch einer vorläufigen Chromosomentopographie bei Gerste. (Attempt at a preliminary chromosome mapping in barley.)
Der Züchter, 1930, **2**, pp. 68–72.
The chromosome number in barley being 7, it ought to be easy to establish the respective linkage groups.
Group I.—From figures by v. Ubisch it has been possible to calculate a linkage with crossing over of 13·24% between number of rows and toothing of the side nerves of the glumes. From results of Huber involving the same characters, the crossing over came to 11·4 or 8·4%. A

crossing over value of 9·57% between awning and number of rows leaves a doubt still whether the awning factor comes at the same side or the opposite side to the tooth factor. One of the factors governing time of shooting is also linked with number of rows, with 42% c.o. Factors governing density, maturation period, height and glume length also appear to be in this group.
Group II.—The factor for smooth awns, *R-r*, is linked with glume colour, *B-b*, and bristles, *L-l*, with c.o. of 31·4% for *B-R*, 28·7% for *R-L*, and 40·48% for *B-L*, indicating the following order : *B-R-L*.
The factor *Albina*$_1$ shews a linkage with *B* with crossing over of 22·9% ; this does not indicate on which side it lies. One of the factors for resistance to *Helminthosporium* is also in this group. Data on the same lines are given for Group III, containing one density factor, naked grains, awn length, and plant height, the latter of which is shewn to lie between the awn length and density factors. The distribution of hairs on the outer glumes is governed by a factor in this group.
Group IV contains two chlorophyll factors, *Xantha* and *Albina*$_2$ and hoods.
Group V contains *Albina*$_4$, *Chlorina* and *Albina*$_3$, of which the positions are given ; further tests are necessary, however, to be quite sure that this group is not a part of one of the other groups.

203. **Porter, R. H., Chen, H. K., and Yu, T. F.** **633.171–2.451.2–1.521.6**
Smut resistance in millet.
Phytopathology, 1930, **20**, pp. 915–16.
Out of a large number of millet selections about 20 were resistant to *Ustilago crameri*.

204. **Elliott, C.** **633.174–2.3**
Bacterial streak disease of sorghums.
J. Agric. Res., 1930, **40**, pp. 963–76.
White Kafir C.I. 342 was the only immune variety.

205. **Jones, J. W.** **633.18:581.162.5**
Sterility in rice hybrids.
J. Amer. Soc. Agron, 1930, **22**, pp. 861–67.
Crosses between members of the *Japonica* and *Indica* group displayed a considerable amount of sterility in the F 1, ranging from 28·89 to 83·61%, whereas the sterility in crosses between varieties within the same group did not exceed 9·61%. The hybrid plants matured abnormally late or failed to mature, and many of the F 2 plants failed even to head out. As all varieties have the same chromosome number ($n = 12$), the cause of this sterility is perhaps some incompatibility of the chromosomes of the two groups, the two groups being somewhat distantly related.

206. **Nagai, I., and Hara, S.** **633.18–2.484:575.1**
On the inheritance of variegation disease in a strain of rice plant.
Jap. J. Genet., 1930, **5**, pp. 140–44.
A race of Corean rice was observed with brown spots caused by *Helminthosporium Oryzae*. The progeny contained healthy and diseased in the ratio 3 : 1. The cross of healthy x diseased gave only healthy plants and the behaviour clearly indicates that the character is governed by a single recessive. It probably arose by mutation.

207. **Sengbusch, R.** **633.367:575**
Ueber Lupinenzüchtung am Kaiser-Wilhelm-Institut für Züchtungsforschung, Müncheberg i. d. Mark. (On lupin breeding at the Kaiser-Wilhelm-Institut für Züchtungsforschung, Müncheberg i. d. Mark.)
Z. Züchtung, 1930, A. **15**, pp. 219–22.

208. **Kočnar, K., and Smerda, V.** **633.41:575.42**
(A contribution to the method of sampling beet roots for purposes of selection.)
Věstník Československ. Akad. Zeměd., 1930, **6**, pp. 257–59.
Selection is more difficult in forage- than in sugar-beets, in that more variation occurs in the distribution of the food materials in the root. Methods of testing used with sugar-beet are therefore not applicable.

209. **Sasaoka, T.** **633.42:575.127.2:576.3**
Karyological observations in different interspecific hybrids of Brassica.
Jap. J. Genet., 1930, **6**, pp. 20–32.
In hybrids of the 19 chromosome x the 10 species, there were 10 bivalents and 9 univalents in the heterotype division. In hybrids between the 19 x 18 species, 10 bivalents + 17 univalents appeared. No irregularities were observed in hybrids between species with 19 chromosomes.

210. **Bartosch, J.** **633.491:575.1 –181:581.446.2**
Untersuchungen zur Genetik der Kartoffel. III. Untersuchungen über die Vererbung der Knollengestalt bei der Kartoffel. (Investigations on the genetics of the potato. III. Investigations on the inheritance of tuber form.)
Arb. Biol. Reich. Land u. Forstw., 1930, **18**, pp. 117–51.
The results of crosses of round x long tubers are reported, and also the results of selfing certain of the individual varieties.
The length over breadth coefficients of the selfed progeny of the two parents of the first cross were examined statistically ; the standard deviations shewed that there was a significant difference between the two. The mean for the F 1 of the cross lay between the two parental means. There were considerable differences in F 2 in the standard deviation of different families. Families occurred with greater variation than the F 1, others on the other hand with less. Significant differences in the mean of F 2 families occurred in both hybrid and selfed progenies. Those with the greatest mean value also had the greatest standard deviation. It is clear that these differences are conditioned by genetic factors. A positive correlation exists between the form of a variety and of its offspring.
Certain of the commercial varieties were selfed and intercrossed, and the F 1 generations studied. Here again the F 1 of the crosses was intermediate between that of the selfed varieties, in all cases when an appreciable difference existed between the two parents. Varieties which closely resembled each other might behave differently on selfing.
The formation of small secondary tubers was also seen to be inherited in F 2, where all intermediate stages occurred between many and no secondary tubers, the plants being arranged in six classes from 0 to 5. The distribution, however, was never binomial, there being an excess in the 0 class. No decision could be made as to the mode of inheritance ; no apparent linkage existed between form of tuber and formation of secondary tubers to account for the irregular distribution.
It was impossible to fit the results of these studies into any scheme of unit factors for tuber shape. The intermediate condition of the F 1 and the fact that the distribution so often approximated to the binomial curve indicates the existence of polymeric factors. The further fact, whatever its explanation, that the longest types shew the greatest variability, brings about certain deviations from a binomial distribution. The fact that several F 2 families from certain crosses contained more than three form groups is further evidence ; and the F 2 families of the parents, when selfed, behaved similarly, indicating that the parents were not homozygous. Moreover, there were strong indications of transgressive inheritance, due to polymeric factors. The figures indicate the presence of at least four equal factor pairs. On this assumption an explanation is offered of the behaviour of certain families.
The length was regarded as a constant character, varying shapes being brought about by varying numbers of genes for roundness, each of which represents a stage in the evolution of the tuber from the normal shoot. Each additional gene for roundness increases the growth in thickness and a stage might be reached in which growth in thickness and length were equal, giving a spherical tuber. The greater the difference between these two rates of growth, *i.e.* the longer the tuber, the greater will be the variability, and this is taken as an explanation of the greater standard deviation of the long tubers.

211. **Kesseler, E. von** **633.491:581.331.2**
Der Pollen von *Solanum tuberosum L.*, seine Keimfahigkeit und das Wachstum der Pollenschläuche. (The pollen of *Solanum tuberosum L.*, its germination and the growth of the pollen tube.)
Angew. Bot., 1930, **12**, pp. 362–418.

Sterility investigations have shewn that this is an important point in carrying out practical breeding. After an extensive review of the literature the author goes on to describe a number of morphological characters of the pollen of various varieties and their relation to its germinating power. The shape is in itself no indication, nor the amount of granulation ; a coarse granulation was an indication of sterility. A much surer test was by colouration with carmine in hydrochloric acid ; the sterile pollen remained uncoloured.
The influence of various factors on the germination is next considered. These are the composition of the culture medium, air humidity, temperature, light. Light has an adverse effect, as also temperature above 35° and below 8° C. The pollen is viable for about 10 days.
The germination of normal fertile pollen under optimum artificial conditions is described, followed by a corresponding description of the germination on the stigma.
The development of the pollen tube in the style and ovary was studied after artificial pollination. Two methods of artificial pollination and the methods of investigating the material are described.
It is clear that the pollen of a particular variety may reach the ovule quite successfully when applied to one variety and not when applied to another. The success of a pollination depends, then, not only on the germinating power of the pollen, but on the compatibility of the two varieties. Moreover, the germinating power of the pollen in vitro is no indication of its behaviour on the style, in that a pollen which in vitro will not germinate may be successful in vivo. On the other hand, pollen which germinates in vitro will almost always reach the ovary.

212. **Lemmerzahl, J.** **633.491–2.411.4**
Neues vereinfachtes Infektionsverfahren zur Prüfung von Kartoffelsorten auf Krebsfestigkeit. (New simplified method of testing potatoes for wart resistance.)
Der Züchter, 1930, **2**, pp. 288–97.
A method of obtaining fresh swarm spores and infecting is described. The reaction can be determined within four hours.

213. **Müller, K. O.** **633.491–2.411.4–1.521.6:575.11**
Über die Phytophthoraresistenz der Kartoffel und ihre Vererbung. (Zugleich ein Beitrag zur Frage der Polyploidie bei der Kartoffel). [On Phytophthora resistance in the potato and its inheritance. (Also a contribution to the question of polyploidy in the potato.)]
Angew. Bot., 1930, **12**, pp. 299–324.
Darwin, as early as 1870, attempted to produce *Phytophthora* resistant potatoes by species crosses, evidently without success. Nevertheless, Broili later also crossed common varieties with S. American types and the author took over the material, with the conviction that success was possible only by studying the developmental phases of the host and parasite in relation to one another. The author corrects and explains on this basis the common idea that the young plants are less susceptible and that early varieties are more susceptible. Varieties commonly regarded as highly resistant proved to be very late ripening types which so escape the period of attack ; they were not truly resistant when tested by artificial infection.
The so-called *W* races resulting from earlier hybridizations, were also tested and proved to be truly immune, the common symptoms of infection did not develop. That their resistance in the field was not a result of a natural tendency to later ripening was proved by comparison with susceptible varieties in disease-free soil, when the maturation period of both types proved to be similar. In infected soils the fungus takes a hold on the *W* races only when they are nearing the end of the growth period, and thus the yield is very little reduced.
In studying the inheritance of resistance, those shewing no infection after 12–15 days were regarded as resistant ; all infected plants were grouped together as susceptible. The F_1, F_2 and F_3 of a cross resistant x susceptible are described. The F_1 contained equal numbers of resistant and susceptible, shewing that one parent was heterozygous.
More than one gene was involved in resistance, since varying ratios were given by different plants from F_1 and F_2, resistant plants giving always more than 50% resistants (sometimes 100%), susceptibles always less.

A study of the F2 families shews at least six types of segregation, indicating the presence of at least two factor pairs, *i.e.* four genes. The figures shew that each of 36 combinations of gametes may give a resistant zygote. This is only possible in tetraploid plants and the author mentions a number of phenomena, of sterility, etc., which lend support to the assumption of polyploidy in the potato.

The author therefore assumes that the four allelomorphic genes act independently and that resistance is only attained when a certain minimal value is attained, each gene having a different value. In this way if gene R_1 has a value—1, R_2 has a value=2, $R_3 = 3$, and $R_4 = 4$, resistance is only attained when the sum of the values of the genes present is 12 or over. The segregation ratios worked out on this assumption agree closely with the experimental results, with certain exceptions which appear to be linked up with certain irregularities of cell division observed by other workers. The results of back-crosses are also in accordance with these assumptions.

Resistance is not closely linked with any of the more important commercial characteristics. This, together with the fact that no physiologically different forms of *Phytophthora* are known, makes it quite possible to build up varieties having the resistance of the *W* races and the desirable characteristics of the commercial types.

214. **Quanjer, H. M.** **633.491–2.8–1.521.6**
La sélection des pommes de terre et l'influence des conditions extérieures, des engrais en particulier. (The selection of potatoes and the influence of external conditions, fertilizers in particular.)
Bull. Assoc. Internat. Sélect. Plantes Grande Culture, 1930, **3**, pp. 81–90.

A method of selection used in the Netherlands, based solely on the selection of plants free from disease. It is shewn that a moderate nitrogen and high potassium manuring checks the spread of the virus diseases.

215. **Kearney, T. H.** **633.51**
Cotton plant, tame and wild.
J. Hered., 1930, **21**, pp. 195–210.

A general description and history of the cotton plant.

216. **Kearney, T. H.** **633.51:575.11:581.441**
Short branch, another character of cotton showing monohybrid inheritance.
J. Agric. Res., 1930, **41**, pp. 379–87.

The character, which consists of the reduction of all fruiting branches to one internode, is one of the few unit characters discovered in cotton. The character was not completely dominant, since most of the fruiting branches on the F1 plants had only one internode, although some had two and one branch three. The F2 was classified on the assumption that all individuals with no fruiting branches with more than one internode were homozygous for short branch, and all individuals on which the longest fruiting branch comprised not less than four internodes were homozygous for normal branch.

The ratios conform quite closely to a 1 : 2 : 1 expectation, on the assumption of a single gene. The F3 observations confirmed these assumptions, plants classed as homozygous shewing no segregation, whereas those classed as heterozygous produced progenies similar to the F2, which also conformed to the 1 : 2 : 1 expectation.

The character is regarded as the product of a single gene mutation and is not linked with any other of the genes studied.

217. **Ware, J. O.** **633.51:575.125**
Hybrid intensification of plant height in cotton and the relationship of node number and internodal length to the phenomenon.
J. Amer. Soc. Agron., 1930, **22**, pp. 787–801.

Egyptian (*Pima*) x Upland (Upright). Parent strains differed only slightly in length of internodes and node number. The mean height of the F1 was 14·71 ins. higher than the mean of the taller parent. This was expressed by increased internode length. Careful analysis and back-crossing showed this to be due to heterosis, while node number in which the parents differed more than in internode length showed full dominance in F1.

218. **Shibuya, T.** **633.51:581.331.2:581.02**
Germination of cotton pollen in artificial culture media.
J. Soc. Trop. Agric., 1930, **2**, pp. 55–64.
The germination of pollen grains on agar-agar with sucrose of varying concentrations was examined. The most favourable concentration proved to be 35 or 40% sucrose plus 5 or 4% agar. Temperature and pH effects were also noted.

219. **Hubbard, J. W.** **633.51:581.46**
Flower buds in cotton bolls.
J. Hered., 1930, **21**, pp. 275–78.
An abnormal type of flower bud discovered in a field of *Acala* cotton is described.

220. **Tammes, T.** **633.52:575**
Die Genetik des Leins. (The genetics of flax.)
Der Züchter, 1930, **2**, pp. 245–57.
A summary of our present knowledge of flax breeding. Length and thickness of the fibres, their number and position, etc., are much influenced by external conditions—manuring, etc.
Eight genes have been established for the blue colour of the common flax. Three basal factors give light pink and the addition of the rest change the colour through deep pink, lilac to blue. Some of these are intensifying factors and one influences the extent of colouration of the petals. The change from the white to the blue flowered form in the course of some years is probably due to the presence of some blue-flowered form among the original plants, or that white consists of different genotypes. A pure line of white-flowered flax grown for 20 years at Groningen has never shown a change of colour. Probably more than 32 colour types exist—for some it is a question of several multiple allelomorphs. Colour of the veins of the petals is also conditioned by several factors. Some of these factors also determine the petal form; the colour of the anthers, which may be blue or yellow, the genetical basis of which has not yet been fully analysed; and pericarp colour.
A cross between the blue-flowered flax and the white-flowered with waved petals, yellow anthers and greenish seeds, $b_1b_1B_2B_2CC$ shows a deficiency of white plants in F2, while white $B_1B_1b_2b_2CC$ crossed with blue shows no such deficit. Prof. Tammes explains the results by the semi-lethal effect of C in the presence of B_1. The character for the pubescence of the septa of the capsule is due in most cases to one factor, but in others to two. The opening of the capsule depends on polymeric factors.
Flower size is, to a certain extent, dependent on external conditions—its genetic analysis is complex and probably two or three polymeric factors are involved. There exists a large number of types for seed size and it has been shown that for length as well as for breadth, the difference is due to two, three or four polymeric factors. Length and breadth show a correlation that, however, is not complete. The difference in dimension of the fruit is probably also due to polymeric factors. Not enough work has been done on stem length and thickness to justify any genetic analysis. Investigation is needed on the character of the fibres and its inheritance. The number of diploid chromosomes varies from 30 to 32.
The gradual degeneration of flax which has been noticed in some districts cannot be due to inbreeding and remains unexplained. An improvement in flax culture by breeding pure lines is advocated.

221. **Laibach, F.** **633.52:581.46:575**
Entwickelungsphysiologische Unterschiede zwischen Lang- und Kurzgriffeln bei einer heterostylen Pflanze (*Linum austriacum L.*). (Developmental-physiological differences between long and short styled individuals in a heterostylous plant (*Linum austriacum L.*).)
Z. indukt. Abstamm.—u. Vererb. Lehre, 1930, **55**, pp. 155–82.
A white-flowered plant with long styles was crossed with a blue short styled. Early counts of the progeny gave much lower numbers of long styled than later counts. The long styled plants

were seen to germinate and flower later. The author points to some similar work of Correns, who found that the female plants of *Melandrium* grew more slowly ; it thus seems that it is the homozygotic type which is the slower in developing.

222. **Henry, A. W.** **633.52–2.452–1.521.6:575.11**
Inheritance of immunity from flax rust.
Phythopathology, 1930, **20**, pp. 707–21.

Losses as high as 20% are caused by *Melampsora lini* and the fibre from infected plants is much less valuable. Certain immune types were discovered, each possessing certain other desirable characters. These were crossed with susceptible types of fibre and seed flax.

The F_1's were immune, immunity being completely dominant. The F_2's were classified as immune or susceptible, any plant bearing rust pustules being put in the susceptible class.

In the first case described the deviation from a 15 : 1 ratio of immune to susceptible is not significant, indicating the presence of two factors for immunity. This is confirmed by the back-cross.

In a second cross, using different immune parents, only a single immunity factor was present, giving ordinary di-hybrid ratios with flower colour, indicating that the two factors were inherited independently. The deficiency of white plants remarked by Tammes was also noted. This is clearly shewn by the F_3 figures. When the rusted and immunes are considered alone, there is a close approximation to a monohybrid ratio.

The F_3 of the first cross gave figures conforming to a ratio of 7 immune : 8 segregating : 1 susceptible, although the numbers of immune were rather higher than expected, the numbers of segregating being correspondingly lower. This is probably the result of incomplete infection.

In the F_3 of the second cross the number of susceptibles is low, largely on account of the loss of susceptibles in F_2, some of which failed to set seed.

Selections were made among the progeny for rust resistance, taking also into consideration such characters as earliness, height, branching and seed characters ; wilt resistance and yield, etc., will be tested later ; fibre types were also selected. The results shew that it will be quite possible to combine a number of these desirable characters, as well as resistance to other diseases, into new varieties.

223. **Catalano, G.** **633.526.23:581.351.1**
Megasporogenesi aberrante in "Agave Sisalana" Perrine. (Aberrant megasporogenesis in "Agave Sisalana" Perrine.)
Nuovo Giorn. Bot. Ital., 1929/30 (N.S.), **36**, pp. 317–24.

This paper forms part of a research into the causes of the sterility of the flowers and the bearing of them on vivipary. The reduction divisions of the megaspore mother cell were followed and the following aberrations were noted.

At diakineses, besides the gemini and the univalent chromosomes, there are often fragments of chromatic material in indefinite numbers ; at the metaphase there is diffusion and expulsion of chromatic material in the spindle and in the surrounding plasma ; at the anaphase, the reconstituted nuclei enrich themselves with new chromatic material. The second division lacks the equatorial plate, the chromosomes are scattered and diffusion and expulsion of chromatic material occurs as in the first division. The products of meiosis are obviously unequal and the tetrads which recur promiscuously, are of various shapes. The behaviour indicates a hybrid origin.

224. **633.61–1.557:575**
New cane yields extra ton of sugar to acre. Seedling developed at Canal Point will beat others by wide margin, cane expert predicts.
Official Record, Oct. 30th, 1930, **9**, p. 3.

One of the seedling canes, *C.P.* 807 has consistently outyielded *P.O.J.* 213, the best of the Javanese canes for Louisiana conditions. The differences in yield of sugar per acre are considerable and the cane is highly resistant to disease. It is one of the seedlings produced originally from *P.O.J.* 213.

225. **Munerati, O., and Costa, T.** **633.63:575.061.6**
Osservazioni sulla transmissione del carattere " pelle nera " nella barbabietola. (Observations on the transmission of the character " black skin " in beet.)
Z. indukt. Abstamm.—u. Vererb. Lehre, 1930, **54**, pp. 458–68.
A full study of the genetic behaviour of the character which has appeared suddenly no less than five times in pure sugar beet strains. It has also occurred in culinary beets. The character is evidently a single Mendelian recessive. In F_2 a certain number of mosaic individuals appear, with dark streaks on a black background, whose inheritance is not yet defined.

226. **Colin, H., and Bougy, E.** **633.63:581.192:575**
Caractères de quelques hybrides de Betteraves. (Characters of some beet hybrids.)
C.R. Acad. Sci. Paris, 1930, **191**, pp. 730–31.
Sugar beets have always higher dry matter and sugar content, and also more vascular tissue than garden beets.
The progeny of Giant Yellow x the sugar beet *Vilmorin A* was analysed. The sugar content n the hybrid generation resembled the sugar beet parent, as also dry matter and ash. The structure also resembled that of the sugar beet parent.

227. **Esau, K.** **633.63–2.8–1.521.6:575**
Studies of the breeding of sugar beets for resistance to curly top.
Hilgardia, 1930, **4**, pp. 415–40.
Individual beets varied in their susceptibility ; resistant strains were developed by selection ; the roots were also selected for size, shape and sugar percentage. The strain selected was compared, with favourable results, with commercial strains. A resistant strain with higher yield and size of roots was developed. Immunity, however, was never attained ; under conditions of greater severity the strain succumbed. Nor was the sugar percentage, shape, vigour, or viability of the seed satisfactory and the strain was therefore crossed with others possessing some of these qualities. One hybrid generation shewed greatly increased vigour and shape of root. One of the hybrids was resistant and gave higher yields than any other resistant strains. Others shewed high sugar content.
Mass selection was also practised, depending on the fact that infected plants tend not to produce seed. The strains so obtained were compared with the original, selected, resistant strain and with the commercial strains. They gave better yields and larger roots and good sugar content, but shewed little uniformity in the matter of resistance and morphological characters.

228. **Esau, K.** **633.63–2.8–1.521.6:575**
Sugar beets resistant to curly top.
Facts about Sug., 1930, **25**, pp. 610–12.
By selecting for resistance a strain yielding much more than normal strains under conditions of infection has been secured.
The resistant strain gave less sugar per unit area under normal conditions, but more under conditions of infection. It had numerous other disadvantages, and was crossed with a variety having good vigour and shape of root, high yield and sugar content. The hybrids were resistant and better in sugar content.
Mass selection for resistance was carried on at the same time with considerable success.
Further work is being done to increase the sugar content of these strains still further.

229. **Kostoff, D** **633.71:575.127.2**
Ontogeny, genetics and cytology of *Nicotiana* hybrids.
Genetica, 1930, **12**, pp. 33–118.
The various types of results of species crosses are discussed in turn. That in which the pollen tubes do not reach the ovary is not regarded as altogether unsuccessful, since the reciprocal is often more successful and the result is much influenced by external conditions as well as the

respective chromosome numbers of the parents, the cross in which the female has the greater number being more successful.

Crosses in which the pollen tube penetrates the micropyle and induces parthenocarpy, or development of diploid endosperm from nucellus tissue, are described and figured. The occurrence of one or other of these two sometimes depends on the time of year, and in summer there was a tendency for the same crosses to give fertilization, with development of embryo and triploid endosperm. This occurred even in genus crosses involving *Petunia*.

In other crosses fertilization occurs but the embryos usually die at an early stage, whilst in still others viable seeds are formed but the plants die in the seedling stage ; no difference could be observed between these plants and those hybrid plants from other crosses which matured normally. These themselves vary very much in vigour in the different combinations of species, in some cases the F 1's shewing considerable hybrid vigour. Taking a constant species as the female parent and crossing it with a series of species each more nearly related to it, the vigour of the F 1 gradually increased to a maximum and then fell off to a point equal to that of the female itself.

The development of the ovule was observed in an interspecific cross. Development was slower and a large accumulation of starch was noted outside the nucellus, its utilization being evidently much slower than in normal seeds. This is evidence of a certain incompatibility between the enzymes of hybrid and parental tissues.

The chromosome behaviour in pollen mother cell formation was studied in the various crosses and the numbers of chromosomes occurring in the pollen mother cells tabulated. The formation or non-formation of gemini was also, in certain cases, influenced by temperature. In the cross *N. paniculata* x *N. tabacum* trivalency sometimes occurred. Many chromosome irregularities apparently result from the reduced rate at which the processes take place in the hybrids.

Certain of the F 1 hybrids were back-crossed with the parents and the resulting hybrid studied cytologically. The offspring of one such back-cross had varying numbers of chromosomes, and chromosome chimaeras were observed in the root tip of a plant having 72 chromosomes, in which cells with 156 chromosomes were observed.

A certain number of the back-crosses were unsuccessful, whilst a number of triple crosses were attained ; these plants were sterile.

A number of irregularities in development of the tapetal cells of the pollen mother cell of F 1 hybrids very much resembled the phenomena associated with attacks by foreign agents, galls, etc., an evidence of the presence of materials not normally present in the somatic cells.

The author finds a striking analogy between the influence of certain agencies such as wounding, temperature, ultra-violet and X-rays on the viscosity of the protoplasm, and their influence on cell division, and it seems evident that the different irregularities are bound up with the different degrees of viscosity. It is suggested with some degree of confidence that the mixing of the germ plasms in species hybrids has a similar effect on the viscosity, bringing about similar results.

There is a discussion of the question of incompatibility in which it is again pointed out that the success of a cross is influenced by temperature, etc., and that it is often possible to effect an otherwise difficult cross under optimum conditions for pollen tube development, etc. There was a clear correlation between the length of style and the power of pollen tube growth of that species, and hence the pollen tubes of a foreign species with very long styles grew faster on *N. rustica* than pollen of *N. rustica* itself. The failure of many pollen tubes to reach the ovary accounts in part for the apparently lower viability of male gametes. The actual male and female gametes were found to be equally viable.

A general explanation of these phenomena is put forward on the basis of different degrees of compatibility of enzymes and consequent formation of varying amounts of precipitins in the tissues which, on account of their hybrid nature, contain enzymes from both parents. The failure of a precipitin test between two individuals is an indication that the two are sufficiently compatible to be crossed. Differences in this quality, just as differences in reaction to disease, may exist within an apparently homogeneous strain. The maximum production of these antibodies is attained only at a certain age of the seedlings and this is taken to account for the dying off of seedlings of certain crosses at this stage. The antibodies in other cases may affect the cells so as to promote growth and so bring about the phenomenon of hybrid vigour.

230. **Heyn, A. N. J.** **633.74:581.162.4**
Die Befruchtung bei Theobroma cacao. (Fertilization in cacao.)
Proc. Koninkl. Akad. v. Wetensch. Amsterdam, 1930, **33**, pp. 533–41.
A number of definite cases of fertilization are described and illustrated. The shedding of fruits is shewn to result from failure of fertilization.

231. **Blaringhem, L.** **633.75:581.46:575**
Hérédité des phases de l'ouverture des fleurs chez les pavots. (Inheritance of the opening stages of poppy flowers.)
C.R. Acad. Sci. Paris, 1930, **191**, pp. 117–20.
Two types of poppy were pure-lined, in the one of which the flower buds are seen to be developing six days before the opening of the flower, whilst the other the flower buds develop rapidly in the last few days before opening.
These differences were expressed in the opening of the stamens and in the movements of the peduncle. The hybrid was like the latter of the two parents.

232. **Appl, J.** **633.812.763.4:575.116.1**
Further contribution on the segregation of a hybrid between *Origanum majorana* ♀ and *Origanum vulgare L.* ♂ in the F_2 and F_3 generations.
Věstník Českoslov. Akad. Zeměd., 1930, **6**, pp. 157–61.
A spontaneous hybrid was discovered between marjoram, *Origanum majorana* and *O. vulgare*. The plant was quite fertile. In the second generation almost all plants were hermaphrodite; all stages appeared between complete sterility and fertility. A number of plants were resistant to disease. Almost all characters were intermediate, there being only one plant which entirely resembled one of the parents. Two linkage groups were established and the crossing over value for certain of the genes calculated. Upright growth habit was very closely linked with winter hardiness and aroma. Some quite new aromas appeared, which may be of some value.
In F_3 there were a number of degeneration phenomena due to chromosome disturbances.

233. **Huskins, C. L., and La Cour, L.** **633.842:576.312.5**
Chromosome numbers in *Capsicum*.
Amer. Nat., 1930, **64**, pp. 382–3.
The number $n = 12$ is regarded as the true condition of *C. annuum*.

234. **Trochain, J.** **633.853.55:575.11**
Le Ricin. (Ricinus.)
Rev. Bot. appl., 1930, Bull. No. 105, pp. 299–308.
Contains sections on the systematics, heredity, selection and physiology, giving an account of the work done on factorial analysis of colour, etc., and the points to be observed in selection.

235. **Jacob, J. O.** **633.912:575.42**
De huidige stand van de Hevea-selectie in Oost-Java. (The present-day position of rubber selection in East Java.)
Bergcultures, 1930, **4**, pp. 485–92.
A general account.

236. **Passecker, F.** **634.1:581.331.2**
Kann man aus der Keimfähigkeit des Pollens in Zuckerlösung auf dessen Tauglichkeit zur Befruchtung schliessen? (Can the value of pollen for fertilization be judged by its germination in sugar solution?)
Gartenbauwissenschaft, 1930, **3**, pp. 201–36.
The germination of pollen of many fruits has been shewn to depend on the composition of the medium used for investigation.
The author concludes that in apples and pears the value of pollen for fertilization can be judged by its germination in artificial media, as the phenomena of physiological incompatibility are not

known to occur in these genera and sterility when it occurs is a result of failure to germinate on the part of the pollen.
In the stone fruits, however, the incompatibility phenomena often occur and in such cases the pollen germination gives no indication of the behaviour of the varieties on crossing.

237. **Murneek, A. E., Yocum, W. W., and McCubbin, E. N.** **634.11:581.162.3**
Apple pollination investigations.
Univ. of Missouri Agric. Exper. Sta. Bull., **138**, 1930.
All apple varieties are more or less self-unfruitful, but there is a wide range of variation between varieties. Varieties which are relatively self-fruitful tend to crop more highly. Varieties shew considerable variation themselves in self-fruitfulness. The causes of self-unfruitfulness are discussed, among these being climate, nutrition, defective pollen and pistil, incompatibility, heterostyly, and cultural practices.
Self-pollination was effected by bagging, and by bagging and application of previously collected pollen. Cross-pollination was effected in the ordinary way. The blooming periods of all the leading varieties are shewn to overlap in normal years.
The percentage set from self-pollination, cross-pollination from a known variety, and out-pollination is given. No variety was sufficiently self-fruitful to be grown alone. Open pollination gave a better set than cross-pollination.
The efficiency of the most important pollenizing varieties is given. Ben Davis, Jonathan and Delicious were distinctly superior to others in this respect.
The greater efficiency of hand-pollination over bagging alone is emphasized.

238. **Einset, O.** **634.11:581.162.5**
Cross-unfruitfulness in the apple.
Tech. Bull. N.Y. Agric. Expt. Sta., 1930, **159**.

239. **Klotz, L. J., and Fawcett, H. S.** **634.3–2.4**
The relative resistance of varieties and species of citrus to *Pythiacystis gummosis* and other bark diseases.
J. Agric. Res., 1930, **41**, pp. 415–25.
Great variations were observed in different trees and different parts of the same tree. The different groups of citrus differed in their resistance.

240. **Schiemann, E.** **634.75:575.127.2**
Über Geschlechts- und Artkreuzungen bei *Fragaria*. (On sex and species crosses in *Fragaria*.)
Ber. d. Deut. Bot. Gesells., 1930, **48**, pp. 211–22.
The genus *Fragaria* is a polyploid series with seven as the basal number; diploid, hexaploid and octaploid species exist.
Three sex forms: male, female and intermediate, are known, the female being heterozygous, the other two homozygous.
In the crosses, all females were fully fertile, as also the primary (phylogenetic) hermaphrodites. A number of different kinds of intermediate forms are described.
The results of hybridization are so complicated that only a large number of sterility factors of different types affords an interpretation. A number of the resulting types, including a series of sterile females, is described.
In crosses of octaploid x diploid, all plants were sterile, having $2n = 35$.

241. **Ichijima, K.** **634.75:575.127.2:576.356**
Studies on the genetics of *Fragaria*.
Z. indukt. Abstamm.—u. Vererb. Lehre, 1930, **55**, pp. 300–47.
The cytological behaviour is described for the types with 7, 21 and 28 chromosomes. Crosses of species within the 7 chromosome group were usually normal in behaviour, but in many cases

the F1 generation was not uniform in morphological characters. Even in these cases no abnormality was evident in the somatic chromosomes.
Hybrids of 7 with the 21 chromosome group were identical with the female parent; if this was the former they had 14 somatic chromosomes, if the latter 42. True hybrids of the 7 x 28 chromosome groups occur in some cases displaying 7 bivalents, and 21 univalents at anaphase, the somatic number being 35, whilst in other cases 7 pairs were present and the plant was identical with the maternal parent.
Crosses between the 21 and 28 groups set no fruit. The species of the 7 chromosome group fell into 4 groups, differing in morphological features and possessing certain cytological pecularities. Members of one group intercross with perfect ease, giving fertile hybrids. Crosses involving the members of one of these groups, the *nilgerrensis* group, always produced dwarfs which never flower. The species which gave a non-uniform F1 proved to be exceptional in that a single chromosome often occurred in place of a pair. This is regarded as one of the probable causes of the non-uniformity. The arrangement thus, into 4 groups, agrees to a large extent with the geographical distribution of the species.
The frequent occurrence of non-disjunction in species and hybrids is taken to indicate the hybrid origin of many of these species.
A number of cases of doubling of the chromosome number in the pollen mother cell, with formation of a tetraploid hybrid, were observed. This hybrid is vigorous and different from other species; it breeds true. The chromosomes at anaphase were frequently distributed irregularly, with 12 or 13 at one pole and 16 or 15 at the other, giving possibilities of still further variation.
One case of an F1 plant of a cross 7 x 28 chromosomes had 56 chromosomes, and resembled the male parent, and it is supposed that the male nucleus developed in the ovule to the exclusion of the female.
There is a short discussion on sex differentiation and inheritance. The variability of the F1 is thought to be partially due to the heterozygous nature of the gametes with regard to the sex factors.

242. **Moog, H.** **634.836.72–2.7–1.521.6:575**
Solonis x *Riparia* 1616 *C.*
Wein und Rebe, 1930, **11**, pp. 460–8.
An account of the hybrid of this name is given. It comprises several forms, form *A* being immune to *Phylloxera*.

243. **Einset, O.** **634.836:581.162.3**
Open pollination *vs.* hand pollination of pollen-sterile grapes.
Bull. N.Y. Agric. Expt. Sta., No. **162**, 1930, 14 pp.
Some of the American grape varieties fruit perfectly when selfed, others are quite self-sterile. The majority are intermediate in fertility.
In the experiments hand pollination was compared with open pollination and in every case gave increased set and more attractive clusters.
A greater increase was given in the case of *vinifera-labrusca* hybrids than with *vinifera* itself, but in all cases it is clear that the agency of the insects is not sufficient for full pollination.

244. **Faes, H., and Collaborators** **634.851–1.541.11**
Etude de l'influence de divers portegreffes sur la qualité et quantité de récolte, IVe série. (Study of the influence of various stocks on the quality and quantity of the yield, IV series.)
Ann. agric. Suisse, 1930, No. 4, pp. 353–97.
The variety *Chasselas fendant* was tried on a number of pure American, Americo-American and Franco-American hybrid stocks, and the grapes examined in great detail with regard to quality, content of various materials, sugar, tartaric acid, etc., and yield.

Certain conclusions based on 20 years' observations are drawn. The substitution of certain old stocks by new ones, and the retention of others was justified. Thus *Solonis* x *Riparia* 1616 and *Riparia* x *Rupestris* 11 *F Dufour* were regularly productive and gave a good quality, sweet product. Among the most outstanding were *Riparia* x *Rupestris* 3309, 3306, 101·14 ; *Chasselas* x *Berlandieri* 41 *B*. Others are recommended for particular conditions of soil, etc. The pure American and the Franco-American could almost always be advantageously replaced by newer hybrids.

245. **Schmidt, W.** **634.972:575**
Forstliche Pflanzenzüchtung. (Breeding of forest plants.)
Der Züchter, 1930, **2**, pp. 189–95.
A discussion of the difficulties of the practice of breeding forest trees and a number of questions which bear on the subject.
Certain properties have proved inheritable, *e.g.* the type of axis in oak, and certain crown and leaf types have been shewn to be associated with vigour of growth. The percentage of autumn (hard) wood varied very widely in different specimens. This would seem to be a valuable basis for selection, especially as it can be estimated by borings. Individuals varied also in resistance to drought, frost, etc., which can now be determined in artificially regulated conditions.

246. **Wettstein-Westersheim, W. v.** **634.972.3:575**
Die Züchtung von Pappeln (*Populus*). (Breeding of poplars.)
Der Züchter, 1930, **2**, pp. 219–20.
One of the most important uses of poplar is in the paper industry and Professor McKee has already been able to breed types yielding 9,000 *kg/ha* as opposed to the 250*kg/ha* of cellulose obtained at present.
In the Kaiser-Wilhelm Institut quick growing hybrids have recently been produced, making use of the phenomenon of hybrid vigour. Several thousand seeds were obtained from 11 crosses. The twigs were cut off in February and flowers developed after two to three weeks. The time of flowering could be adjusted by altering the temperature.

247. **Walker, J. C., and Smith, R.** **635.34–2.484**
Effect of environmental factors upon the resistance of cabbage to yellows.
J. Agric. Res., 1930, **41**, pp. 1–15.
The effect of environment (temperature) on a number of lines homozygous and heterozygous for resistant factors.

248. **Smith, R., and Walker, J. C.** **635.34–2.484–1.521.6**
A cytological study of cabbage plants in strains susceptible or resistant to yellows.
J. Agric. Res., 1930, **41**, pp. 17–35.
Resistance was found to be entirely dependent on some quality of the protoplasm.

249. **Pearson, O. H.** **635.44:575.061.6**
An albino mustard.
J. Hered., 1930, **21**, pp. 221–23.
Plants of *Brassica campestris* produced albino seedlings in the ratio 3 : 1.

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INDEX.

Anonymous, 106, 121, 125, 225
Appl, J., 232
Avery, P., 153

Balde, H., 176
Baltzer, U., 188
Barnes, H. F., 119
Bartosch, J., 210
Baur, E., 143
Beadle, G. W., 195
Bhalerao, S. G., 115
Blaringhem, L., 231
Bleier, H., 173
Bougy, E., 227
Bremer, C. A., 122, 123
Brewbaker, H. E., 191
Brieger, F., 145
Broekema, C., 136
Brown, A. M., 107, 108, 110
Buchinger, A., 175

Calder, J. W., 103
Catalano, G., 223
Chen, H. K., 203
Coffman, F. A., 182
Coleman, D. A., 180
Colin, H., 226
Costa, T., 226
Cotter, R. U., 109
Cunliffe, N., 112
Curzi, M., 147

Darragh, W. H., 113
Delaunay, L., 169
Deming, G. W., 200
Dusseau, A., 174

East, E. M., 152
Einset, O., 238, 243
Elliott, C., 204
Esau, K., 227, 228

Faes, H., 244
Fawcett, H. S., 239
Fedorova, N., 181
Fleischmann, R., 190
Frenzel, H., 186
Fruwirth, C., 151

Ghimpu, V., 201
Goodspeed, T. H., 153
Gouldzn, C. H., 110

Hall, A. D., 127
Hara, S., 206
Harrington, J. B., 104
Havas, G., 159
Hayes, H. K., 191, 193
Heald, F. D., 177
Henry, A. W., 222
Heyn, A. N. J., 230
Hijhouwer, A. P. C., 155
Hubbard, J. W., 219
Hume, A. N., 194
Huskins, C. L., 233

Ichijima, K., 241
Immer, F. R., 191

Jacob, J. O., 235
Johnson, T., 107, 108
Jones, D. F., 189
Jones, E. T., 111
Jones, J. W., 205
Jorgensen, M., 132

Kakizaki, Y., 146
Kearney, T. H., 215, 216
Kesseler, E. von, 211
Khan, A. R., 118
Kienholz, J. R., 177
Kiesselbach, T. A., 192
Kihara, H., 161, 165, 168
Kindermann, M., 149
Klotz, L. J., 239
Kocnar, K., 208
Kohler, E., 157
Kostecki, E., 134
Kostoff, D., 140, 229
Kuckuck, H., 199, 202
Kyle, C. H., 198

La Cour, L., 233
Laibach, F., 221
Lemmerzahl, J., 212
Lesley, J. W., 131
Lesley, M. M., 131
Levine, M. N., 109
Liepin, T., 162

Majmudar, V. M., 126
Mangelsdorf, P. C., 196
Maximov, N., 156
McCubbin, E. N., 237
McIntosh, A. E. S., 124
Melburn, M. C., 105
Mitscherlich, E. A., 150
Moog, H., 242
Muller, H. J., 142
Muller, K. O., 213
Munerati, O., 225
Murneek, A. E., 237

Nagai, I., 206
Nakamura, S., 160
Newton, M., 107, 108, 110
Nilsson, N. H., 183
Nishiyama, I., 161, 165

Ossent, H. P., 187

Passecker, F., 236
Patterson, J. T., 142
Pearson, O. H., 249
Philiptschenko, J., 163
Porter, R. H., 203

Quanjer, H. M., 214

Ranker, E. R., 197
Raum, H., 172
Reed, G. M., 184
Roberts, W., 117
Robertson, D. W., 200
Robertson, H. T., 166
Roodenburg, J. W. M., 135

Sapehin, A. A., 170
Sasaoka, T., 209
Saxena, B. P., 114
Scheibe, A., 178, 179
Schiemann, E., 240
Schmidt, W., 245
Schnyder, A., 171
Sengbusch, R., 207
Sessous, 144
Sethi, R. L., 114
Shibuya, T., 218
Singleton, W. R., 189
Sirks, M. J., 137
Smerda, V., 208
Smith, R., 247, 248
Spinks, G. T., 128, 130
Stakman, E. C., 109
Stevenson, F. J., 167
Stoletova, E. A., 148
Stubbe, H., 141
Swanson, A. F., 133

Tammes, T., 220
Tavcar, A. von, 158
Tedin, O., 185
Thompson, W. P., 139, 166
Trochain, J., 234
Tschermak, E. von, 164
Tydeman, H. M., 129
Venkataraman, T. S., 120

Wakakuwa, S., 168
Walker, J. C., 247, 248
Ware, J. O., 217
Waterhouse, W. L., 102
Weiss, F. E., 101, 116
Wettstein-Westersheim, W. v., 246
Wiebe, G. A., 182
Winkler, H., 138

Yocum, W. W., 237
Yu, T. F., 203

Zeigler, O., 154